Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER AND AMERICAN ELECTRICIAN.

VOL. 57. NEW YORK, THURSDAY, JUNE 8, 1911. No. 23.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

239 WEST THIRTY-NINTH STREET, NEW YORK.

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TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3.00 per year; Canada, $4.50 per year. All other countries, $6.00 per year. Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. Date on wrapper indicates the month at the end of which subscription expires.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday of the week of issue.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1910 *was* 974,750. *Of this issue* 17,500 *copies are printed.*

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AN UNUSUAL STATION CONSIDERATION.

The power station of the Northern Heating & Electric Company, of St. Paul, is a curious and interesting example of the adaptation of station design to topographical necessities, which incidentally conveys some very useful lessons. The plant is situated on the side of a cliff, its base being against the river bank, while the sixth story, which contains the general offices of the company, is at the level of the city street. The result of the necessities of this situation has been a curious, but convenient and practical, up-and-down design for the station. The advent of the steam turbine has made it possible to adopt in the interior arrangement of stations methods quite out of the question with reciprocating engines. The turbine when properly constructed and installed spins so steadily and smoothly that it imposes very slight strains on the foundations other than those due to its mere weight. In several stations advantage has been taken of this fact to place the turbines directly above the boilers so as to bring the amount of steam piping to a minimum and give the maximum of output for the ground space occupied. This arrangement has been highly successful and ought to be used in the interest of economy far oftener than it is. The St. Paul station utilizes something very like this principle of construction in virtue of the peculiar topography of the station site.

On the ground floor at the base of the cliff are the boilers with a coal crusher and conveyer in the basement under the spur track that brings the coal to the station. The cliff being cut away leaves room for the main front of the building into which the boiler-room opens on the lowest floor, providing room for the feed-water tanks and exhaust steam piping. On the second floor, above this extension of the boiler-room, are located the turbo-generators, and still above these is the floor containing a machine shop which brings the building front at last up to the level of the city street. In a still further excavation of the cliff, and under the sidewalk in front of the general offices, space is provided for the transformer room and all the switching apparatus. Above the general offices on the street floor are rooms for the engineering staff and for storage. The rear of the building above the boilers and the economizers, which latter are on the same floor with the turbines, is a huge space occupied for coal-storage bunkers. These bunkers will hold 1500 tons of coal in each of the three bins, and each bin supplies the pair of boilers beneath it. The furnaces are automatically stoked and are worked with induced draft, so that the short smokestack rises but a short distance over the roof of the building. The compactness of design is very extraordinary and the convenience in operation resulting from it is advantageous to no small degree.

Almost equally unusual is the construction of the distributing tunnels for the underground service from this station. The main distribution is at the generator pressure of 2300 volts.

although one of the substations is fed at 6600. The rock formation under St. Paul is peculiar. Under a shallow layer of soil lie about 25 ft. of extremely hard blue limestone, very difficult to excavate. Below this lies a layer of soapstone and hard sandstone and under this again a very soft sandstone, which is easily cut. Almost from necessity, therefore, the public utilities of various kinds are forced into deep tunnels and the geological situation has been taken advantage of in the fullest manner by the Northern Heating & Electric Company. Its tunnel system in this soft sand rock, 25 ft. to 40 ft. below the surface of the street, is some 8000 ft. in length. The tunnel is 6 ft. high and 3 ft. wide, giving room for electric cables and some steam-heating mains. The distributing transformers are located in chambers cut out alongside the tunnels, and the cables leaving the transformers rise through shafts drilled in the hard rock above into the service connections or into the cellars of buildings served. These drill holes are 4 in. to 6 in. in diameter and are consequently made with comparative ease. Through the same tunnels are served some 275 steam-heating customers, the heating service being measured by means of condensation meters. The plant is not a large one as modern plants go, containing at present only 4300 kw in equipment; but both as regards the design of station and nature of the distribution it is certainly a most interesting example of clever adaptation of methods to circumstances.

POWER-FACTORS AND LOAD-FACTORS.

So far as concerns the required increase in kilovolt-ampere rating of generators a load-factor of a certain low percentage is equally disadvantageous with a power-factor of the same percentage. However, in their effects upon other parts of the system a low power-factor is essentially different from a low load-factor. For example, with an average load of 100 kw at unity power factor, a load-factor of 80 per cent would require a complete installation of boilers, engines, generators, transmission circuits, etc., for 125 kw; with an average load of 100 kw at unity load-factor, a power-factor of 80 per cent would require an equipment for only 100 kw in boilers and engines, but would necessitate 125 kva in generators, transmission circuits, etc., while the voltage regulation would be much less satisfactory than under the conditions of unity power-factor and 80 per cent load-factor. A load-factor of 80 per cent, combined with a power-factor of 80 per cent, necessitates an increase in the boiler and engine equipment of 25 per cent, with an increase in generating and transmitting equipment of 56.25 per cent, and results in very poor voltage regulation. It will be appreciated, therefore, that designing and operating engineers are vitally interested in the character of the load upon supply systems as well as in its average value.

Much information relating to the character of load found upon alternating-current systems was given in a paper read by Mr. F. D. Newbury at the New York convention of the National Electric Light Association, as abstracted elsewhere in this issue. Although dealing largely with the power-factors of the various types of consuming apparatus, yet some idea is given of the maximum demand as shown by the consumption of the different motors under starting conditions. The highest power-factor is attributed to incandescent lighting loads and the lowest to electric welding loads, if an exception be made of synchronous apparatus, the power-factor of which can be adjusted at will. It would seem that from all points of view the welding load is the most disadvantageous, in that its power-factor is extremely low and its load-factor very poor.

The power-factor of the induction motor varies from a low value at no-load to a satisfactorily high value at full-load. The high value under load does not, however, mean an improvement in conditions over those existing at no load; the lagging wattless component of the kilowatt-amperes, to which the low power-factor at no load is attributed, not only does not decrease but actually increases with increase of load. To a large extent the effects that are usually attributed to a low power-factor are caused by and vary almost directly with the wattless component of the kilovolt-amperes, such as the demagnetization of the generators and the reduction in the delivered emf. While the magnetization of an induction motor requires a certain amount of wattless kilovolt-amperes, quite independent of what other machines upon the system are consuming or furnishing, yet it is not necessary for this amount to come from the generator; a portion, all, or even an excess, may be produced locally by means of machines of the synchronous type operated with over-excited magnetic circuits. Such machines consume leading wattless kilovolt-amperes which may be used to neutralize an equal amount of lagging wattless kilovolt-amperes taken by the induction motors.

With the appreciation of the disadvantages of the lagging wattless kilovolt-amperes of the induction motor has come a realization of the advantages of the synchronous motor in permitting the value of the wattless component of its kilovolt-amperes to be changed from lagging through zero to leading; so that at the present time the so-called synchronous condenser is a familiar auxiliary to the alternating-current supply system. It is not too much to expect a rapid introduction of alternating-current motors possessing simultaneously in a single unit the desirable characteristics of the induction motor and the synchronous condenser.

THE N. E. L. A. ACCOUNTANTS' PROGRAM.

That the accountants interested in the National Electric Light Association have put their separate sessions to good use was proved sufficiently by their attendance at and participation in the meetings last week. The subjects of the papers were diversified, and in nearly every case the discussion which followed the presentation of the paper brought out differences of practice or arguments that added substantially to the value of the proceedings. As is shown by the abstracts of papers and discussions published elsewhere in this issue, the range of topics covered several matters that concern the executive and operating departments, and thus the general policies as well as the internal affairs of the company. The accounting activities of the association are under the direct charge of one committee, whose title indicates no more than its duties with regard to the uniform accounting system. That has been no bar to a marked increase in enthusiasm at the meetings, and the subjects that may be taken up with profit will probably continue to be greater in number rather than less. Adequate provision for this enlargement of activities might be made by the appointment of new standing committees or committees to take up suggested subjects from year to year, or by the enlargement of the scope and membership of the present committee. The adoption of

the latter alternative would permit the appointment of sub-committees to take up specific topics assigned by the general committee, and would afford a means for occasional meetings of a number of those actively engaged in the work. This plan was followed by the committee last year in the consideration of one or two matters, but the work might with benefit be further broadened.

Certainly no one will question that the need for a correct understanding of sound accounting principles is urgent. One of the first issues raised by the new Public Service Commissions was that of the classification of accounts. If there is substantial uniformity of practice among the companies of the country, the possibilities of uniformity in the systems prescribed by the commissions will be strengthened materially. Since the association has approved the standard classification of its committee it remains for the companies individually to incorporate the system in their policies, unless they have objections that are too strong to be overcome. If such objections relate to the text of the classification, it is important that they be placed in the hands of the committee for consideration. We have no authority to speak for the committee in any way, but realize that its principal work lies in the formation of a classification which has the official sanction of the association. The plans of the committee, subject to approval by the executive committee of the association, provide for the creation of a statistical bureau. It is apparent at once that data of the nature which it is proposed to exchange derive their value largely from the fact that they are determined by uniform methods. Like results cannot be obtained by unlike methods. It is important that standardization in accounts be effected, and if this end is not attainable with the present system, such changes should be made as will adapt the classification to the needs of the largest possible number of companies. A system of accounts, like any other feature of the business, requires revision as conditions change. It should be analyzed carefully and periodically with this fact in mind. Undoubtedly companies that have experimented with the classification will be willing before the end of another year to relate their experience and thus afford a starting point from which many others may determine the applicability of the accounts to their regular operations.

ORGANIZATION PROBLEMS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Over 5000 persons were registered at the New York convention of the National Electric Light Association last week. It is probable that not all of that number were present at the various functions of the association on any one day, for no doubt there were some registered in advance who were unable to attend at all, while others went away before the convention was over. But if a deduction as high as 20 per cent be made for this discrepancy between registered and actual attendance, the figure of 4000 remaining is still very large. And, indeed, everyone present must have been impressed by the sheer bigness of the gathering. Notwithstanding the very admirable advance preparations and all the resources of the Engineering Societies Building, it was almost impossible for any one person to keep in touch with the various activities of the convention. To some extent the unparalleled registration was due to the fact that the convention was held in New York, with its large population of persons interested in electrical pursuits, but it also reflects the remarkable increase in membership of the association itself, for the N. E. L. A. has now nearly 9000 members of all classes.

The growth in size both of the organization itself and of the annual convention foreshadows new and important problems of organization. In his annual address the retiring president, Mr. W. W. Freeman, said that there is nothing to prevent the total membership from reaching perhaps 25,000. Obviously, as Mr. Freeman points out, new methods of procedure must also follow changes in the complexion of the organization. One plan suggested is to intrust to the geographic sections, as they increase in number and in facilities for practical accomplishment, much of the important educational work now performed by the national organization. This procedure would entail less inconvenience and expense to the local companies than the plan now followed, and has for a precedent the successful sectional distribution of work by the Illuminating Engineering Society. Mr. Freeman said that it has been suggested seriously that the national convention, ultimately and perhaps shortly, should be limited to a given number of representatives of member companies, to discuss broad questions of policy and issues of common interest. Details of engineering and commercial practice may then be left to geographic and other sections. An alternative plan is to organize national special sections for the promotion of special lines of work, as illustrated by the present Commercial and Power Transmission Sections.

Mr. Freeman's conclusion is that probably neither plan would alone meet the situation fully. Both ideas are in operation to some extent and are working toward an ultimate solution of the problem. Whatever this ultimate solution may be, as a matter of common prudence the policy of the association will be to proceed with caution in striving to reach a correct determination. At the New York convention several amendments to the constitution were adopted to broaden the scope of the company, geographic and national special sections. Provision has been made for the admission of persons "interested in advancing the central-station industry" on recommendation of Class A or company members. Other amendments are intended to fix more definitely the status of the sections, while at all times retaining the control of the present association, and hence of all sections, in the hands of Class A members.

Many persons will view with reluctance the possibility of giving up a big, rousing general convention for all hands, but with the growth of the industry and of the association the likelihood of a delegated general convention becomes increasingly probable as an apparently necessary method of preventing the annual convention from becoming too bulky to accomplish useful work under practical conditions. However, the step is one not to be taken lightly, for the smaller Class A members may look upon it with some apprehension. It is a good subject for a general and thorough discussion, and at any rate is still some distance in the future. The Seattle convention of next year, at least, will be one of the old-fashioned—we have no doubt many will say the good old-fashioned—kind. By that time the combined wisdom of those who take an active interest in the association may result in a practicable working plan to meet the needs of the future.

The Mississippi Convention.

For the third annual convention of the Mississippi Electric Association to be held in Gulfport, Miss., June 20, 21 and 22, unusually elaborate preparations have been made. A handsome souvenir program has been printed, and it shows that both meetings and entertainments have been carefully planned. On the opening day there will be an address of welcome by Judge J. H. Neville, followed by President Greenland's annual address. Papers to be presented thereafter include the following: *Relation of Employees to Company and Public,* by Mr. A. B. Patterson; *Modern Street Lighting,* by Mr. J. N. Eley; *Electrically Heated Appliances,* by Mr. L. Callender; *Economy of 750-kw Engine,* by Mr. D. R. Tomlinson; *Steam Turbines,* by Mr. Edmund Dreyus; *Necessity of Commercial Department,* by Mr. A. H. Jones; *Economical Care and Maintenance of Street Cars,* by Mr. Jack Abbott. In addition there will be a Question Box and a general assembly on Thursday morning, June 22, especially for Class B members.

Entertainment features include sight-seeing and shopping in Gulfport for the ladies and a reception and dance on Tuesday evening. On Wednesday afternoon there will be a trip to Beauvoir and Biloxi on the interurban railway, while in the evening there will be a banquet, Judge Neville being toastmaster. On Thursday morning, after the general assembly, there will be an excursion to Ship Island by boat, and some special features are promised for this trip.

The Mississippi Electric Association, which is affiliated with the National Electric Light Association, has these officers: President, Mr. S. W. Greenland, Columbus; vice-president, Mr. Jack Abbott, Jackson; secretary and treasurer, Mr. A. H. Jones, McComb. Other members of the executive committee are: Messrs. A. B. Patterson, of Meridian; H. Crittenden, of Greenville; F. J. Duffy, of Natchez, and S. M. Jones, of Laurel.

Finale of the New York Convention.

The concluding feature of the New York convention of the National Electric Light Association of last week was commensurate in every respect with the remarkable gathering of which it formed the appropriate finale. It consisted of a combined inspection of riverside power plants and an excursion on the East and Hudson rivers on Saturday. The weather was threatening all day, with dashes of rain, but notwithstanding, 960 convention delegates and visitors, including many ladies, made the trip. Assembling at Waterside No. 2 station of the New York Edison Company, the party inspected first the turbine-room and next the boiler-rooms of that imposing demonstration of the dignity and magnitude of the electric service in the greatest of American cities. Courteous guides were in attendance and all features were carefully explained. The Waterside No. 1 station was not open for inspection, owing to the installation of the 20,000-kw units at the present time.

Next, the party embarked on the steamboat *Majestic,* chartered for the occasion by the New York Edison Company. To each visitor was presented a booklet giving information on the electric power houses of New York, with an itinerary of the trip, and a most acceptable map. Copies of the *Convention Daily* of Saturday were distributed, and with these and the booklets, and watching the extremely interesting coal-handling operations of the Waterside stations, the early arrivals on the boat passed the time until the lines were cast off.

Leaving the foot of East Fortieth Street, the boat proceeded north on the East River to the Astoria (L. I.) plant of the Consolidated Gas Company, which was inspected. Here, too, the arrangements were most complete in every detail, the plan of rallying groups of visitors at guide stations being particularly ingenious and effective in handling so large a party. This great gas-making plant is electrically operated throughout, and the scientific methods exemplified were most interesting to the visitors.

Returning to the boat, each visitor was handed a box of luncheon, with the compliments of the New York Edison Company. While the boat retraced its course down the East River this appetizing luncheon was discussed at hundreds of impromptu but merry luncheon parties of ladies and gentlemen. Non-alcoholic drinks were served before and during the luncheon, and at its conclusion there was ice-cream, while Edison men followed with packets containing cigars, cigarettes and matches, all cleverly done up in wrappings displaying the well-known "At your service" manikin of the New York Company. The arrangements for the luncheon were happily conceived and carefully carried out.

Meanwhile, the *Majestic* was proceeding south on the East River, rounding the Battery and going north on the Hudson to the foot of West Fiftieth Street. This gave the visitors a fine view of the East River bridges and New York's waterfront and was greatly appreciated by the out-of-town visitors, who drank in the scene with delight.

At the power house of the Interborough Rapid Transit Company on Fifty-ninth Street near the Hudson a stop was made to view this large, modern and unusually interesting station, with its double-ended boilers, combined vertical and horizontal engines and exhaust-steam turbines. Following this, most of the members of the party re-embarked and took a farther trip up the Hudson, landing at West Forty-third Street about 5:30 p. m.

The courtesy of the New York Edison Company in giving this delightful trip to convention visitors was highly appreciated. It is safe to say that every guest was pleased and grateful. Mr. Freeman, the retiring president of the N. E. L. A., and Mr. Gilchrist, the new president, were both present and "took in" the sights together. The sub-committee of the entertainment committee in charge consisted of Mr. J. W. Lieb, Jr., chairman, and Messrs. W. R. Addicks, Clarence L. Law, Frank W. Smith, H. G. Stott, Henry Stephenson and W. F. Wells.

Operating Organizations at the Convention.

Coincident with last week's convention of the National Electric Light Association, or at about the same time, several of the large electric-service operating organizations of the country gathered their clans in New York. Thus the Doherty Operating Company held a convention at its New York offices on May 26 and 27, just before the convention. Dr. John Wesley Hill addressed the meeting on the first day, his subject being "Brains and Business," and on Saturday night, May 27, the gentlemen in attendance, to the number of nearly 100, were the guests of the management at a beefsteak dinner at Healy's restaurant. Mr. H. L. Doherty was not present, as he is taking a well-earned vacation in Europe. Nearly all the Doherty men remained for "the big show."

On Monday night, May 29, J. G. White & Company, Inc., gave a dinner in the Yacht Room, Hotel Astor, to about fifty gentlemen connected with that organization. This organization is the operating manager of about twenty-two public-service companies in Maine, Connecticut, Pennsylvania, Delaware, Georgia, Michigan, Illinois, Iowa, Nebraska, Oklahoma, Montana and the Philippine Islands. Mr. J. G. White made an address at the dinner, and among others present were Messrs. F. H. Reed, J. H. Pardee, R. B. Marchant, H. S. Collette, T. W. Moffat, L. H. Conklin, S. D. Sprong, E. R. Welles, W. R. W. Griffen, W. B. Rockwell and J. A. Fleet.

H. M. Byllesby & Company were represented by a delegation including Mr. Byllesby himself, who read a paper before the convention on Friday, June 2. Mr. A. S. Huey, of this organization, was elected second vice-president of the N. E. L. A. and was awarded the Crouse loving cup for bringing in the largest number of members to the Commercial Section. This organization operates in ninety-three municipalities in thirteen states of the West and South. On Thursday evening, June 1, Mr. Byllesby gave a dinner at the Metropolitan Club. Among

the guests were Messrs. C. A. Coffin, Samuel Insull, S. Z. Mitchell, F. C. Walcott, J. J. O'Brien, T. K. Jackson, Harold Almert, E. L. Callahan, Samuel Kahn, H. C. Hoagland and William H. Hodge.

The Stone & Webster interests were represented by about fifty delegates, headed by Mr. W. H. Blood, Jr., past-president of the N. E. L. A. Included in this number were Messrs. H. J. Gille, N. T. Wilcox, C. F. Wallace, F. J. Hovey, R. W. Child, J. S. Bleecker, W. J. Grambs and C. C. Curtis. Messrs. Blood, Gille and Wilcox presented papers or reports before the convention. At the close of the convention the Stone & Webster men proceeded to Boston, where an informal meeting was held on June 5 under the direction of the home office.

Electrical Development in the Philippines.

BY LOUIS R. FREEMAN

The Philippine Islands, with their great mountain area and enormous rainfall, have great hydroelectric possibilities, and it is hardly an exaggeration to say that there is not a single town in the whole archipelago which is not within transmitting distance of water-powers. The time is particularly ripe for hydroelectric development to supply Manila and several other points in Luzon, but nothing thus far has been done owing to the failure to enlist capital.

The largest electrically operated plant is, of course, that of Manila, owned by the Manila Light & Railway Company. The generating and railway plant of this company was built by the J. G. White Company, and at present consists of two 750-kw, one 1500-kw and one 2000-kw Westinghouse three-phase turbo-generator. The current is generated at 360 volts, that portion required for railway service being converted into direct current by rotary converters.

Mr. C. B. Graves, vice-president and general manager of the Manila Light & Railroad Company, informed the writer that the Japanese coal which his company uses is comparatively high-priced and of but fair quality, making the generation of electricity from steam power considerably more expensive than in the United States. Borneo coal is not of good quality and, although much is hoped from them, little has yet been done with any of the coal prospects in the Philippines themselves. The demand for electricity is increasing at an encouraging rate, both through its increasing use in the large tobacco factories and small manufacturing plants of the island capital and through a realization on the part of the natives—who do a great deal of their work by night—of its safety and economy as a lighting medium in their highly inflammable houses. The general use of electricity by the natives, however, cannot be expected until energy is furnished at a considerably lower figure —the price is now 20 cents, gold, per kw-hour—than at present, a consummation Mr. Graves does not believe practicable until the installation of hydroelectric plants in the vicinity of Manila reduces the cost of production to the company. The steady extension of the street-car lines into the suburbs will also demand more power for operation than can be furnished by the present steam plant, and this Mr. Graves expressed himself as being hopeful of developing from water-power. This company has had several hydroelectric power-plant sites, all within easy transmitting distance, under observation for some time.

Lighting bills, Mr. Graves said, will always be higher in Manila than in America. The larger rooms and numerous windows necessitate the use of more light than is common in the United States, where the rooms are smaller and the larger amount of wall space increases the reflective power of the light. It is also true that the fixed charges are higher than at home, while deterioration is heavier. Besides that there is a purely local problem in the high peak between 6 and 9 in the evening, and the comparatively small amount of energy used in manufacturing does not give the distribution of cost that companies operating in America and elsewhere enjoy.

Concerning hydroelectric conditions, rainfall is very heavy, averaging about 100 in., but 90 per cent of the precipitation is between the months of May and October inclusive. Over 85 per cent of the area of the islands consists of mountains, and this makes for heavy gradients and many storage possibilities. Were a market available hundreds of thousands of horse-power could be economically utilized. The industrial conditions at the present time are at such a feeble state of incipiency that it is doubtful if more than 25,000 hp or 30,000 hp could be utilized in the archipelago at even very cheap rates.

As to market, the Manila Electric Light & Railroad Company uses about 5000 hp for its peak load, while tobacco factories, machine shops, mills, etc., may total 10,000 more. Outside of Manila the city of Baguio and its surrounding gold-mine prospects might utilize 2000 hp, while the cities of Iloilo, Cebu, Zamboanga and Vigan might utilize up to 1000 hp each. The Mindore Development Company, which has taken up some 60,000 acres of sugar land on the island of Mindore and intends to construct a modern mill, may offer a market for a large project on that island. The company has its own engineering staff and what data it may have gathered in the hydroelectric line have not been made public.

The Manila Railroad Company has a franchise to construct, and is now constructing, a steam line to the north of the town of San Fernando, Union Province. The northwest coastal plain, extending north from San Fernando to the town of Laoag, Ilocos Norte, some 150 miles north, may in time offer inducements for an electric line. The coastal plain, varying in width from 5 miles to 10 miles, is thickly settled, and the locality is one of the most prosperous in the Philippines. The greatest drawback in building a line in this territory would be the excessive cost of bridge construction, as the line would cross quite a number of good-sized rivers. Economical hydroelectric power could be cheaply developed at any one of a dozen points along this line.

Owing to the climate, and especially the heavy typhoons, transmission lines have to be of a very strong and permanent type. Considering the available markets it is not believed that energy could be economically transmitted over 50 miles. Within that radius of Manila are four feasible projects which would each probably develop from 3000 hp to 5000 hp, at an installation cost of less than $100 per horse-power. There are the Gumain River at a point about 45 miles northeast of Manila, the Angat River at a point about 40 miles north of Manila, the Carigara River at a point about 40 miles southeast of Manila, and the San Juan River at a point about 30 miles southwest of Manila.

Within a radius of 20 miles of Baguio and the mining district in that vicinity are perhaps a dozen streams on which could be developed many thousands of horse-power were there a market for it. The largest of these projects would be on the Agno River at a point about 12 miles east of Baguio. It is estimated that 40,000 hp could be developed at this point.

The head office of the irrigation division is at Baguio, and as fast as the field data are received they are recorded and filed in standard forms for public use. Rating curves, hydrographs, run-off tables, etc., are being prepared as rapidly as possible for all permanent gaging stations. It is the intention of the engineers in charge to extend this investigation until all perennial streams of the islands are under investigation.

Evolution of the Electric Railway.

In the course of an address upon the occasion of the presentation to Mr. Frank J. Sprague of the Edison medal at the recent annual meeting of the American Institute of Electrical Engineers, Mr. W. B. Potter, of the General Electric Company, gave an interesting account of the evolution of the electric railway, of which the following is an abstract:

Referring to the early experiments of Davenport, the Vermont blacksmith, in 1834, the work of Davidson in Scotland in

1838, of Professor Farmer at Dover in 1847, Professor Page of the Smithsonian Institute in 1851, of Hall in Boston in 1851 and 1860, it was pointed out that while successful so far as they demonstrated that a vehicle could be propelled electrically, they bore no real fruit in the art of transportation as the primary battery was the only source of power they possessed. The practical railway had to wait for the development of the electric generator, and the first electric railway which resembled the final type in that it received its energy from an electric generator was installed by Siemens at the Berlin exposition in the year 1879.

From this date the progress of the art was continuous and effective, the work of Edison and Field following close on that of Siemens. In 1880 Edison built and operated an electric locomotive at Menlo Park, this being the first practical development of electric traction in this country. The first application of the electric railway to public service was made by Siemens at Lichterfeld, in Germany, in 1881, and during the two years following the commercial development seems to have been mainly in Europe, Siemens installing a road at Portrush, Ireland, which was opened in 1883.

The work which led more especially to the commercial development of the electric railway in this country began in 1883. An electric locomotive was built by Field and Eickemeyer and exhibited at the Chicago Railway Exposition. It was during this year that Van Depoele began his experiments with an electric car in Chicago. His advent deserves special mention, as Van Depoele thereafter, by reason of his foresight and inventive ability, contributed largely to the development of the electric railway. During the same year Draft, who will ever hold a prominent place, sharing honors with Van Depoele, operated at Saratoga an electric locomotive hauling a passenger car.

In 1884 the Sprague Electric Railway & Motor Company was organized by Mr. Sprague. Bentley & Knight appeared during this year and contributed to the development by operating in public service at Cleveland, Ohio, an electric car taking energy from electrical conductors in an underground conduit. This was the first demonstration of the conduit system as afterward installed in New York City and Washington, D. C.

In 1885 Daft built an electric locomotive for the Ninth Avenue line of the Manhattan Elevated, which in appearance and arrangement was not unlike the electric locomotive as built today. He also installed in Baltimore a surface road using an electric locomotive with a third-rail as the principal conductor, but with an overhead conductor and under-running contact at road crossings, a combination of electrical conductors to meet special conditions which has been in use since that time.

During the same year Van Depoele equipped an electric railway at Toronto, the first road in Canada, which, as it had an overhead-trolley wire throughout its length with an under-running contact at the end of a trolley pole, was the forerunner of our modern trolley. Henry, in Kansas City, and Short, in Denver, also began their electric-railway experiments about this time.

Sprague, whose name has been so prominently associated with electric-railway development, built his first car equipment in 1885. His motor was really the prototype of the modern single-reduction railway motor. It was supported at one end by bearings on the car axle and at the other end was flexibly attached to the car truck. This method of supporting the motor, commonly known as nose suspension, is now in almost universal use. The motors were shunt-wound and a regenerative method of control was used, energy being returned to the line when reducing the speed of the car. The arrangement of the motor field winding was also such as to produce a commutating-pole effect to improve commutation. These motors were undoubtedly the first to use a fixed brush holder and the same brush for running in either direction. A demonstration of this equipment was given by Sprague at the Durant Sugar Refinery, Brooklyn, and a more important public demonstration on the Thirty-fourth Street branch of the Manhattan Elevated early in 1886.

In 1887 Sprague secured the contract for the electrical equipment of the Union Passenger Railway, Richmond, Va., and the road was opened for traffic in 1888. The large number of equipments and the severity of the service conditions made the fulfilment of this contract the most notable achievement in the development of electric-trolley lines up to that time; indeed, it was the first effective demonstration of the trolley system as a practical commercial enterprise.

Considerable progress was made by others during 1888. Beltley and Knight equipped the Observatory Hill line in Allegheny, Pa., and the Thomson-Houston Company, which had absorbed the Van Depoele interests, made its first demonstration at Revere Beach, Mass.

Eickemeyer, to whom the industry is indebted for the idea of form-wound coils for armatures, put into operaton at Long Island City electric cars driven by a combination of side rods and gearing. Steinmetz was associated with Eickemeyer during has later development of the side-rod drive without gears. It was about this time that Van Depoele applied the carbon brush to the railway motor, seemingly a simple thing to do, but a detail of improvement found to be essential to the operation of all high-voltage commutating machines whether running as motors or generators. To this all will bear witness who were in the field early enough to have had sad experience with metal brushes.

Shortly after this the Bentley-Knight interests were absorbed by the Thomson-Houston company. In 1890 the Sprague Electric Railway & Motor Company was absorbed by the Edison General Electric Company, and during the same year the Westinghouse Electric & Manufacturing Company began its electric-railway development.

Limitations imposed by the characteristics of the early motors had led to a general use of double-reduction gearing which was recognized to be a disadvantage on account of both its inefficiency and the noise. In 1890 Parshall, then with the Wenstrom Company, designed a motor which by reason of its more powerful and slower speed armature made the use of single-reduction gearing practicable. Following this, in 1891, all of the manufacturing companies discontinued building double-reduction motors and brought out motors with single-gear reduction, which has been the standard-type gearing since that date.

The series-parallel controller, which effected a material reduction in the energy required by the car, and also the inclosed-frame railway motor, an improvement in the mechanical design of motors, were developed by the Thomson-Houston Company in 1892. It was during this year that the Thomson-Houston Company and the Edison General Electric Company were merged into the General Electric Company.

The pioneer work with the trolley car had been accomplished and electric railways were now accepted as a new and better mode of transportation. Some idea of the tremendous growth in America in practically a single decade can be gathered from the fact that while in 1888 there were only 172 electrically propelled cars on 86 miles of road, in 1899 there were over 41,000 electric cars operating on upward of 14,500 miles of road.

The next development of importance was the multiple-unit control devised by Sprague in 1897 and installed by him during that year on the South Side Elevated Railway, Chicago. The multiple-unit control, as its name implies, provides with equal facility for the control of one or a number of motor-cars in a train. Train service had previously been accomplished with trail cars hauled by an electric locomotive or by a single motor-car equivalent to a locomotive. It would be difficult, if not impossible, to meet the requirements in many instances of our present-day train service with a single motive-power unit. High tractive power and the elimination of switching at terminals is essential to high schedule speeds and close headway between trains, conditions which are fulfilled to an admirable degree by the multiple-unit arrangement. As an illustration of the powerful motor equipment which is little in evidence on a multiple-unit train it was pointed out that an electric locomotive even of the weight and power of those used by the New

York Central Railroad would be incapable of handling an express train of the subway at the present schedule.

During the last ten years much has been accomplished in the development of methods and apparatus extending the scope of electric railways and leading up to the more general electrification of railroads now operated by steam. The single-phase system and the adoption of higher direct-current voltages made possible by the addition of commutating pole to railway motors, improvements in methods of generating power and in trolley and third-rail construction cover, in brief, the nature of the work. It is also during this period that the three-phase system first found a commercial application in America, although it had been previously used in Europe to a considerable extent.

Norwegian Hydroelectric Developments.

At the May meeting of the Faraday Society Mr. A. Scott-Hansen, C. E., of Christiania, Norway, read a paper on "Hydroelectric Plants in Norway and Their Application to Electrochemical Industry," from which the following details are abstracted:

The physical configuration of Norway is remarkably favorable for the utilization of the large number of waterfalls to be found on the seaboard of the mountain chains which almost cover the country, and through whose valleys the enormous quantity of water precipitated from the western and southeastern sea breezes finds its way as rivers flowing down to the sea. In the winter the rainfall takes the form of snow, so that the volume of water brought down by the rivers is at its greatest from May to July, when the snows melt on the mountains. To make use of the water-power storage is therefore necessary, and for this the country is from its nature peculiarly adapted, it being covered with lakes that have very contracted outlets and which can be easily converted by damming into storage reservoirs. Thus in the watershed of Skien the natural water-power of 50,000 hp has been increased to an available horse-power of 375,000, while the Mösvand reservoir has increased the water-power of the Rjukan factories from 30,000 hp to 250,000 hp with a capital outlay of only some $425,000. (*Electrical World*, Dec. 9, 1909.)

The total water-power in Norway has been estimated at from 5,000,000 hp to 7,000,000 hp, but as much of the country has not been hydrographically surveyed, this is probably too low an estimate. The power stations can supply power at from $5.50 to $11 per annual electrical horse-power, and in some cases even for less, and as the quantities available are as high as from 50,000 hp to 100,000 hp for a single fall, the conditions are ideal for the development of electrochemical and electrometallurgical industries. Many such industries have already reached an advanced stage of development. Thus nearly 180,000 hp will be utilized this year in the manufacture of nitrates of lime, soda and ammonia from the air by the Birkeland-Eyde process and the Badische Analin und Sodafabrik Company's process (*Electrical World*, April 27, 1911); about 60,000 hp are employed in the manufacture of calcium carbide, and other electrochemical and electrometallurgical industries absorb at present some 20,000 hp. Now that a suitable electric furnace—the Grönwall—has been designed for the smelting of iron ore, a furnace that has yielded excellent results on a practical scale, electric iron and steel smelting is likely to develop largely in the near future, for Norway possesses extensive deposits of iron ore. Three plants, aggregating 16,000 hp, with provision for increasing to nearly 60,000 hp, are now being erected at Hardanger, Arendal and Tinfoss. Other ores, notably copper, nickel and zinc, will also possibly be electrically smelted at no distant date.

On the Glommen River, in the east, three falls are utilized. The uppermost, Kykkelsrud, yields about 40,000 hp, of which 10,000 kw is transmitted at 60,000 volts (three-phase, 50 periods) to Christiania, 31 miles away, and the remainder to Sarpsborg. At Sarpsborg occurs the lowest fall of the Glommen, and here there are two power stations—Hafslund, supplying 24,000 hp to calcium-carbide works and for zinc smelting, and Borregaard, whose output of 26,000 hp is utilized by the Kellner Partington Paper Pulp Company, Limited, owning the largest works in Norway. The intermediate fall on the Glommen is at Vamma, where a dam is now in course of construction under considerable difficulties. This dam will have a height of 90 ft. and will be one of the largest in Europe. The power station will be in the center of the river bed below the dam and will yield some 70,000 hp to 80,000 hp.

A large number of the minor power stations in the south supply the towns with light and power. Among the smaller electrochemical works are the electro-iron and steel works of Arendal, the experimental nitrate works of the Badische company at Christiansand, and nickel and aluminum factories near the same town. The nickel works refine nickel matte and turn out about 400 tons of the pure metal per annum. At Gjössingfjord is Mr. Albert Hiorth's small experimental electro-steel works. At Vadheim, on the west coast, is a sodium factory, and at Trondhjem, in the north, carbide, ferrochrome and ferrosilicon are manufactured.

Another great power center is in the Telemarken district in the southeast of Norway. The Svaelgfoss power station supplies 40,000 hp to the nitrate factory at Notodden at a voltage of 10,000, delivered without transformation. The four 10,000-hp machines—capable of developing 13,000 hp—are among the largest in the world. A power station now being constructed at Lienfoss will be able to furnish Notodden with a further 20,000 hp. The Tinfoss Works, also at Notodden, are intended to generate 15,000 hp, to be used mainly for iron and steel smelting.

The third of the great Norwegian falls is the celebrated Rjukanfoss waterfall on the Maaneely River. The Mösvand dam, above this fall, provides a reservoir of about 840,000,000 cu. m (tons) of water, and 5 miles below is another dam, forming the intake for the power station situated 1000 ft. below. A lower fall of about 1000 ft. provides the power for a second station. Both of these power stations—the largest in Europe—will yield 140,000 hp, there being in each ten units of 14,000 hp. The turbines, on account of the great height of the falls, are Pelton wheels. The construction of the dams, flumes and power stations at Rjukanfoss was attended with great engineering difficulties, which are described in the paper. The power from these stations is transmitted through sixty copper and aluminum cables to Saaheim, where factories for the manufacture of nitrogenous products to employ from 2000 to 3000 persons are in course of erection.

The power plant at the Tysse falls consists of seven units, each of 4500 hp, from which electric energy is transmitted at 12,000 volts to Odda, where it is used for the manufacture of calcium carbide and of cyanamide. Here again, on account of the steep, mountainous character of the country, great difficulties presented themselves, particularly in the drilling of tunnels 1320 ft. above the fjord and in fixing the flumes, some against a smooth precipice with an inclination of 60 deg. The Tysse power station will eventually yield in the neighborhood of 100,000 hp.

In the discussion it was brought out that in some instances the cost of Norwegian water-power is as low as $3.75 or $4 per year.

New Telephone Rates in Greater New York.

In the New York City interborough telephone rate case the Public Service Commission of the Second District has ordered a reduction of interborough telephone rates from the Borough of Manhattan below 110th Street to the Borough of Brooklyn (except Coney Island and Bath Beach), and from the Borough of Manhattan below 110th Street to the central-station districts of Astoria and Newtown on Long Island. The reduction in this case is from 10 cents to 5 cents. Reductions of from 15 cents to 10 cents are made in the service from Manhattan below

110th Street to the central-station districts of Flushing, Richmond Hill and Jamaica on Long Island. These reductions are ordered as the result of an inquiry conducted by the commission on its own motion to determine whether certain toll rates charged by the New York Telephone Company are just and reasonable.

In explaining its reasons for arriving at these conclusions the commission notes the magnitude of the subject matter involved. In the city of New York, with an area of 326 sq. miles and a population by the last census of 4,767,883, the New York Telephone Company has more than 400,000 telephone stations used by subscribers, and in addition a large number of public pay stations. During the year ended Nov. 1, 1910, a total of 30,132,330 toll messages were transmitted, for which the gross earnings were $3,114,345.

The opinion of the commission was rendered by Chairman Stevens. The opinion points out that in the determination of this case the commission had in mind the total investment of the company, its investment in the city of New York, the general cost of operation, the necessity of making reservation out of income for surplus and contingencies, returns actually received by the company from its operations in the city of New York, the rates established for long-distance service elsewhere, the length of call from zone to zone, the rates established from each zone to every other zone, the varying density of traffic, the probable relative cost of service from zone to zone and a number of other factors.

From the financial statement furnished by the company it is said that the total investment of the company in the city of New York is $110,582,897, and the net earnings from the property $10,757,000. It is understood that these net earnings are reached after deducting from gross earnings the operating expenses, taxes and a proper depreciation reserve, so that the 9.7 per cent of net earnings to investment is all available for dividends.

In the financial statement there is an item of $30,000,000 as the value of special franchises. Another value given among the intangible assets is that mentioned under the head of "going concern" and placed at at least $10,000,000. The commission points out that the reduction in revenue by the new rates would reduce net earnings from 9.7 per cent to 6.8 per cent on the showing of the company. However, if the $30,000,000 claimed as value of franchises be eliminated the percentage of net earnings to investment will be 11.8 per cent, and if there be further elimination of the $10,000,000 mentioned as the value of "going concern," the percentage of net earnings to investment will be 13.5 per cent. The commission also calls attention to the fact that the figures do not take into account any increase of business which would be caused by the reduction of rates.

Bearing in mind these considerations the commission remarks that there is a demand for toll service in the city of New York which is not satisfied because the cost now exceeds the value. In other words, there is a large demand for service for which the consumer can afford to pay 5 cents, but for which he cannot afford to pay 10 cents. It is the duty of the company to meet this unsatisfied demand if it can be done with due regard to financial results.

The new rates apply for a connection of five minutes or less. For overtime each five minutes, or fraction thereof, may be charged as another call. A large increase in the telephonic service, because of the reduced rates, will require additions to the plant and equipment of the company in order to enable it to perform the service efficiently, and for this reason the company should be allowed a reasonable time in which to make the necessary additions to its plant. It is the judgment of the commission that the months of June and July will be reasonably sufficient for this purpose, and the company will not be required to charge the reduced rates until Aug. 1, 1911. It is understood that the company has expressed its acceptance of the decision of the commission, although perhaps further time will be asked than the period which is mentioned in the decision.

Ohio Public Utility Bill.

The public utility bill, as prepared by a conference committee, was passed by both houses of the Ohio Legislature last week and is now before Governor Harmon. This committee restored many of the amendments that were eliminated by the Senate and provided for closer supervision of public utilities.

The bill places interurban railway, water transportation and express companies under the laws governing steam railroads, and also applies generally to electric light and power, telegraph, telephone, artificial-gas, natural-gas, gas and oil pipeline, waterworks, heating or cooling, messenger, and signaling companies. Telegraph and telephone companies are considered common carriers and are to be treated as such.

The commission is given power to examine officers of companies as witnesses and to require officers and employees to produce books, papers and documents for examination. Disobedience or refusal to appear in answer to a summons subjects the offender to contempt proceedings before a court of common pleas. The commissioners and duly authorized employees and examiners shall have access to the books of public utility companies whenever it is deemed necessary.

The commissioners and examiners and employees shall have access to the offices and plants of public utilities at all times, for the purpose of making such investigations as are considered necessary for the protection, convenience or safety of the public or the safety of employees, to ascertain whether the operation is in compliance with the laws and the rules of the commission and to secure data. Each public utility must, when required, file a copy of contracts with other public utilities with the commission. The commission may devise a system of accounts for utilities or may divide them into classes and establish a system for each. Companies may be required to keep no other records except those provided by the laws of the United States and the State, if deemed advisable.

Every utility shall furnish just and reasonable service, and the charges shall be just and reasonable and not more than is allowed by law or by orders of the commission. Charges shall be uniform, and no free service for the purpose of destroying competition shall be rendered. Within ninety days after the act goes into effect each company shall file a printed schedule with the commission, showing all rates. The commission may prescribe the form for such schedules, which must be open for public inspection.

Companies are not prohibited from entering into arrangements with customers for a distribution of the profits or from providing a sliding scale or a minimum charge for service, unless such minimum charge is prohibited by the franchise. Subject to the approval of the commission, rates may be graded upon the basis of the quantity used, and other arrangements may be made for the benefit of customers so long as they are reasonable and just and all are treated alike under similar conditions. Rebate or refund of a portion of the charges is prohibited.

Contracts made before the passage of the act may stand unchanged except where they provide for termination on notice. Then the commission may terminate such contracts by order, if it chooses.

A utility must give the commission thirty days' notice of its intention to make any change in rates. Upon complaint of unjust or unreasonable rates, insufficient service or anything else of the kind, the commisson must notify the company and set a date for a hearing. The company has a right to make complaint and to be heard in the same manner. If the commission shall consider the rate too high or low, it shall, with due regard to the value of all the property used for the public convenience, exclusive of any franchise value with the exception of such sums as may have been paid for the franchise, and exclusive of any value derived from a monopoly of service or through mergers, fix a rate that seems just and reasonable, or substitute a schedule; thereafter no change shall be made unless on order of the commission. The commission may give a rehearing, rescind former orders or take such

other steps as may be made necessary by further knowledge in any case of the kind mentioned. The same conditions apply as to the character of service given, the equipment of plants and the conveniences furnished the public.

The commission shall have authority to appraise the properties of all public utility companies, but before a final decision is reached shall give a hearing, if requested, and summon witnesses and follow the same methods as in any other hearing. Properties may be revalued at any time.

The commission may direct that extensions and repairs be made to a plant in order that proper and adequate service may be rendered, after a hearing is had, to show that such repairs or extensions are actually needed for the service and convenience of the public.

Every public utility company having equipment on, above or under streets shall, for a reasonable compensation, permit such equipment to be used by other companies, when found necessary and when joint use does not work irreparable damage to the owners. In case of disagreement, the compensation or conditions shall be fixed by the commission.

Rates may be suspended temporarily by the commission in cases of emergency.

Units of service shall be determined where this is possible and companies shall furnish a complete report of their business in such units in order that the cost may be known. Certain standards of service may be fixed, and certain rules for examination and testing of the service or product may be established by the commission. Tests of apparatus for measuring service may be made, and any consumer may have his apparatus so tested by the payment of a fee.

No person may be excused from testifying before the commission or from producing such books or documents as are requested, but all persons are immune from prosecution because of any incriminating evidence that may be so given.

In case of disagreement between the interested companies on a joint rate the commission may investigate and apportion such rate.

Where steam, interurban or suburban railroad companies' tracks intersect, cross or connect, such connections may be required as will permit interchange of business. The expenses shall be apportioned between them, and they shall give proper service for passengers or freight.

In cases where municipalities fix the rate of a public utility company for a future period, within one year before the old ordinance expires, an appeal to the commission may be taken within sixty days after the passage of the ordinance. Should the conclusion be that the rate is too low or too high, the commission may substitute another rate, with due regard to the value of the property actually in use for the service of the public. This does not apply to street-railway franchises granted under the general code.

Every public utility company shall carry a proper depreciation fund whenever the commission decides that such a fund can be reasonably required. The commission must decide upon the amount that should be charged to cover the necessities of the company. Such funds shall be used for repairs, renewals and extensions that will maintain the property in adequate condition to give reasonable service.

Before a telephone company can establish an exchange on a permit or franchise granted before this act was passed, but not yet exercised, or on any permit or franchise granted in the future in a municipality that already has service, it must secure from the commission a certificate that the plant is necessary to the public convenience. The object of the section appears to be to control the installation of a dual service.

A public utility or a railroad or electric railroad may, upon order of the commission, issue stocks, bonds, notes and other evidences of indebtedness, payable at more than twelve months after date, when necessary for the acquisition of property, the construction, completion, extension or improvement of facilities, the improvement or maintenance of service, the reorganization or readjustment of indebtedness or capitalization, the discharge or lawful refunding of obligations, or the reimbursement of moneys actually expended from income or from other money in the treasury not secured from the issue of stocks, bonds, notes or other evidences of indebtedness within five years next prior to the filing of the application therefor. The commission must set out clearly in its order the kind of securities, the purpose for which the funds are to be used, the terms for which they are to run and the rate of interest.

In case of the organization of a new company or companies to acquire a property in the hands of a receiver at the time this act goes into effect, the requirements do not apply, except to the extent of limiting the securities, exclusive of those issued for additional capital, to an amount not to exceed the aggregate evidences of indebtedness of the old company.

No company shall declare any stock, bond or scrip dividend or divide the proceeds of the sale of any such securities among stockholders without consent of the commission. Capitalization of franchise value, except such money as shall have been paid a political subdivision for the franchise, shall not be authorized by the commission, nor shall the capital stock of consolidated companies exceed the combined capital stock of the original companies at par, except for such amounts as are actually paid in addition to such combined capital stocks; neither shall contracts of consolidation be capitalized nor bonds be issued against such contracts.

With the consent of the commission, but not otherwise, any two or more public utilities furnishing a like service in the same municipality or locality, or any two or more public utilities whose lines intersect or parallel, may enter into contracts to operate their lines or plants in connection with each other. Any public utility may purchase, lease or sell its property, plant or business to any other such public utility. Any such public utility may purchase the stock of any other such utility. The commission must be satisfied that such consolidations will benefit the public and that a better service at just and reasonable rates will be furnished thereby.

One section, which provides for the consolidation of telephone companies, is based upon a point which was the subject of extended discussion throughout the session of the Legislature. Two or more companies whose properties lie within or partly within the State, when they shall have complied with the orders of the commission and the requirements of this act, may consolidate. Such companies must file a joint petition in which all the details of the terms must be set forth. If, after a hearing, the commission is satisfied that consolidation will be of public advantage and convenience and that adequate service will be furnished at reasonable rates, it shall make an order of consolidation. No consolidation shall be valid until after the commission has ascertained the value of the properties concerned, and upon this valuation all charges must be based.

Telephone companies may be required to connect their lines in order to give a continuous service between localities. Joint use of equipment may be required to accomplish this purpose, but at all times the tolls for joint service must be reasonable, and the commission shall have power to apportion charges among the companies.

Neglect or refusal to obey the orders of the commission or disobedience of the requirements of this act subjects companies to a fine not to exceed $1,000 for each offense, and officers or employees may be punished by a fine of not less than $100 nor more than $1,000 for each offense, or imprisonment not to exceed two years, or both. Each day's continuance shall constitute a separate offense. Action to recover in such cases shall be brought in the name of the State. In addition, the company shall be liable to any person, firm or corporation injured through disobedience of the orders of the commission or the laws, in treble the amount of damages actually sustained.

Any company dissatisfied with an order of the commission relating to rates, service or anything else of the kind may commence proceedings in the Common Pleas Court of Franklin County or the county wherein the principal office is located, to set aside the order as unreasonable and unjust. The order

of the commission shall continue through such proceedings, however, unless the company shall elect to operate under the rates or rules in force for the period next preceding the issue of new rates or orders, when bond shall be given for the protection of patrons in case the commission is sustained by the court.

Utility companies may grant free service to the United States, the State of Ohio or any political subdivision in the State, or for charitable purposes, fairs and expositions, or to employees and their families.

No permit, franchise or right to own, operate or manage any public utility, known in this act as an electric light company, gas company, waterworks company or heating and cooling company, shall hereafter be transferred to any corporation not duly incorporated under the laws of Ohio. Companies formed for this purpose, though they may not have acquired any property, are to be subject to this act.

The bill appropriates $75,000 per year for the support of the commission, but fees may be charged for copies of papers and other services. When complaint is filed against a corporation and the commission conducts a hearing on the complaint, the expenses shall be paid by the corporation in case the finding is against it.

Under the act the Railroad Commission shall become the Public Utilities Commission. The act is to be in force from June 30, 1911, if signed by Governor Harmon.

There is general speculation as to the effect of the passage of the public utilities bill on telephone service. The first move toward consolidation will probably be made in one of the larger cities, as Cleveland, Toledo, Columbus or Dayton. Cincinnati has never had but one system. Bonds of the Cuyahoga Telephone Company have advanced from 83 to 89 on the Cleveland Stock Exchange since the passage of the public utilities bill.

Wisconsin Commission News.

The Railroad Commission of Wisconsin has authorized the Peninsular Power Company to issue 7500 shares of stock of the par value of $100 each, for money only and at not less than par. The stock is to be issued for the purpose of supplying the company with funds for purchasing certain designated properties in Dickinson County, Michigan, and Florence County, Wisconsin; for the purchase of all rights, powers and privileges incident to the construction and maintenance of a dam across the Menominee River, near Iron Mountain, Michigan; for paying organization expenses; for acquiring overflow lands and other property necessary for the purposes of the company; for constructing and equipping an electric power plant. The company proposes to install a 3000-kw hydroelectric plant and to increase the total output to 4000 kw by means of steam auxiliaries.

The commission has received a complaint from citizens of Lodi, Wis., in which it is alleged that the municipal plant of Lodi is charging unreasonable and excessive rates for electric energy for lighting; that discrimination is being practised in the application of the meter-rental provision of the schedule. The hearing has been set for the latter part of June. The Village Board of Park Falls has complained informally that the rate charged by the Park Falls Water, Light & Power Company for street lighting is excessive.

A bill has recently been before the lower house of the Legislature which provides that physical connection between competing telephone systems be made compulsory and that no duplication of systems in cities be permitted. The advocates of the bill regard the telephone business as a natural monopoly, and as such competition can be permitted only after the commission has investigated the conditions and has concluded that public convenience and necessity require more than one system, all questions pertaining to the administration of the bill, should it become a law, are left to the Railroad Commission.

New York Commission News.

After investigating the New York Public Service Commission, First District, at the request of Governor Dix, Mr. John N. Carlisle submitted a report in which he commends the commission from every viewpoint, based upon the work accomplished by the commission since its inception in 1907. In commenting on the subway problem, which will probably be settled definitely during the present week, Mr. Carlisle said:

"Undoubtedly the question as to the route is a very important one in connection with an operating company, but my own opinion is that the public officials, in order to give to the people of New York a comprehensive and adequate subway system, should themselves determine where such a system should be built and should require the operating company to comply with the routes laid out by them, and not permit the operating company to fix the routes itself. Similar delays will always result in connection with subway construction unless the public officials take the bull by the horns, lay out the routes which they believe are best suited to the people of New York, commence construction promptly, and then procure operators.

"The view that no operator can be procured is in my opinion absurd. The great congestion of population in New York will make any subway operation very profitable upon any kind of fair terms. The only fair criticism that can be laid against the commission in connection with the delay is that after they had laid out the Triborough route they were apparently willing to postpone action and negotiate for a change of route to suit the demands of proposed operators."

The Public Service Commission, Second District, has granted authority to the Long Island Lighting Company, recently organized for the purpose of taking over several companies on Long Island, to issue a first mortgage upon all its property and franchises, conditioned to secure the payment of its 5 per cent bonds payable twenty-five years from date to the aggregate amount of $6,000,000. The company is authorized to issue its capital stock to the amount of $300,000 at not less than the par value thereof. The company is also authorized to issue bonds upon the security of its mortgage to the aggregate amount of $295,000. Bonds are to be sold at such a price as will produce to the company, after paying all commissions, expenses and discounts, not less than 85. The proceeds of the stock and bonds are to be used for the purchase of the capital stock and outstanding bonds of the Northport Electric Light Company, Amityville Electric Light Company, Sayville Electric Company, Islip Electric Light Company; for new construction from Northport to Commack, Commack to Islip, Islip to Sayville, and Islip to Babylon; for a low-tension line from Brentwood to Central Islip and Sayville to Ronkonkoma, and also for general improvements in apparatus and overhead construction throughout the entire territory which it covers. The company is also authorized to commence construction of the new transmission lines and other parts of its improved system whenever it shall have acquired all the stock and bonds of the Northport, Amityville, Sayville and Islip companies.

The Syracuse Lighting Company has been authorized to exercise rights and privileges under franchises granted by the town of Manlius, Onondaga County, giving the company permission to construct and operate an electric transmission line in that town.

The Marion Power Company has been authorized to issue 6 per cent bonds to the amount of $9,500, the bonds to be sold at not less than par and the proceeds used for the construction of a plant of the company in Marion, Wayne County.

The commission has approved of the sale, transfer and assignment to the Federal Telephone & Telegraph Company of the franchises held by the Warner Telephone Company, Penn Yan Telephone Company, Wayland Independent Telephone Company, Clifton Springs Telephone Company, Livingston County Telephone Company, Salamanca Telephone & Telegraph Company, which companies operate in the villages of

Gowanda, Lima, Dansville, Livonia, Genesee, Honeoye Falls, Penn Yan and Wayland.

Maryland Commission News.

The Maryland Public Service Commission last week concluded the consideration of complaints that the service furnished by the Easton Light & Fuel Company was not satisfactory. The commission went to Easton to make inquiry and Chief Engineer Phelps also made an investigation. In a report to the board the latter recommended extensive improvements to the plant of the company in order to remedy the defects complained of. In an order signed last week the commission directs the company in detail as to what must be done and requires that it shall submit plans for doing the work within ten days.

City Solicitor Poe has conferred with President Aldred, of the Consolidated Gas, Electric Light & Power Company, relative to an adjustment whereby Baltimore consumers would be furnished gas for 80 cents per 1000 cu. ft. Mr. Poe is quoted as saying that if the price of gas and electricity is not voluntarily reduced before Oct. 1 the city will petition the Public Service Commission. Mr. Aldred has promised to take up the question when he returns from abroad, which will be some time during the present month. As the result of an investigation recently made, Dr. C. E. Munroe, of Washington, reported that gas could be manufactured in Baltimore for 55 cents per 1000 cu. ft., leaving a profit of 35 cents on each 1000 cu. ft. The commission sent to the Consolidated company on March 9 a letter asking, on behalf of the city solicitor, information as to the cost of producing and distributing gas. While this information was refused, Commissioner Laird said that he did not feel called upon to demand the information since the city's case was not at that time up for consideration by the commission. The letter expressed a hope that the gas and electric rate problems could be solved without the necessity of further controversy. In his reply President Aldred said that by reason of the recent reduction in the price of gas from $1 to 90 cents per 1000 cu. ft. the consumers of Baltimore saved $300,000.

New Jersey Public Utility Commissioners on Competitive Franchises.

On Sept. 15, 1910, the Atlantic Highlands Gas Company filed a petition seeking to obtain a franchise in order to supply gas to the inhabitants of Shrewsbury Township, Monmouth County, N. J. About two months later a fifty-year franchise was granted by the township committee and accepted by the company. However, it appears that the Consolidated Gas Company of New Jersey had been previously granted a franchise for Shrewsbury Township. This franchise was granted in 1895, and for a number of years the Consolidated company has supplied gas through pipes laid in Shrewsbury Township. Furthermore, it was shown that the Consolidated company is now laying pipes to supply gas to much the same section of the township as the Atlantic Highlands Gas Company desires to serve.

The conflict was referred to the Board of Public Utility Commissioners of New Jersey, and in a decision handed down May 31, 1911, the board announced that it withheld its approval from the franchise granted to the Atlantic Highlands Gas Company. It was stated that the commissioners could not find that the franchise conferred by the recent ordinance is "necessary and proper for the public convenience" nor that it "properly conserves the public interests."

In its opinion accompanying this decision the board says that the creation of various boards and commissions with supervisory powers over public utilities demonstrates that the illusive doctrine of competition in the field of public utilities is being superseded by an experimental régime of strictly regulated monopoly. Often the competition in the end results in increased prices to consumers. There appeared to be no exceptional circumstances in the Shrewsbury case, and the addition of a competing company with permit to supply like service in the same general region would involve sanctioning the general idea of competition.

However, the board does not by its refusal of a competing franchise express itself as approving the price for gas now set by the Consolidated Gas Company. This price is $1.50 per 1000 cu. ft. On its own initiative, the Board of Public Utility Commissioners has called a hearing for the purpose of determining whether this rate is just and reasonable. This hearing will be held at 11 a. m. on June 13, in the State House in Trenton.

Among other business recently transacted, the New Jersey board has ordered an exhaustive inquiry into the recent accident on the Belvidere division of the Pennsylvania Railroad at Martins Creek, which resulted in the death of twelve persons and injuries to many others.

Among recent complaints has been one from the borough of Haworth and others against the New York Telephone Company in relation to the alleged failure of the company to supply service.

CURRENT NEWS AND NOTES.

Canton Meeting of Ohio Society of Engineers.—Canton, at which the Ohio Society of Mechanical, Electrical and Steam Engineers was organized ten years ago, has been chosen as the next meeting place for the convention to be held on June 17 and 18, 1912.

Seattle Convention of N. E. L. A.—As announced in our issue for May 18, Seattle has been selected as the National Electric Light Association convention city for 1912. The executive committee has as yet not chosen the exact date for the Pacific Coast convention, but it will probably be held during the first week in June.

New York Meeting I. E. S.—At a meeting of the New York Section of the Illuminating Engineering Society, to be held in the Engineering Societies Building on June 8, Dr. Sydney W. Ashe will present two papers, entitled "Comparison of Illuminants" and "A Graduate Course in Illuminating Engineering."

M. I. T. Bequests.—Gen. T. C. DuPont has given $500,000 to the Massachusetts Institute of Technology, to be applied to the purchase of a new site. The institute will receive nearly $500,000 from the bequest of Mrs. Emma Rogers, widow of Dr. William B. Rogers, the first president of the institute, and somewhat more than this amount from the fund created by Mr. Francis B. Green. Combined with the aggregate gift of $1,000,000 from the State, these amounts will be sufficient to purchase the proposed new site and erect the necessary buildings.

Animated Electric Sign for Circus.—A large circus now touring the West sends a huge spectacular electric sign along with its advance agent to the larger cities which it visits. The sign shows a bareback rider, with horse and equestrienne in natural and rapid motion. Tungsten sign lamps are used exclusively in the display, the circuits making up the loping positions being arranged on the secondaries of two sets of low-voltage transformers, controlled from flashers on their primary sides. The sign is erected on roof tops in the larger cities where the circus remains more than a day and where electricity is available. As a publicity measure this sign is considered one of the best investments of the circus' advertising department.

No Wisconsin Summer Convention This Year.—Mr. George B. Wheeler, of Eau Claire, Wis., president of the Wisconsin Electrical Association, announces that there will be no summer convention of that association this year. The annual convention of the association is held in Milwaukee beginning on the third Wednesday in January.

Damage Caused by Snow Slides Repaired.—Last March the power plant of the Pacific Hydroelectric Power Company at Mono Lake, near Bodie, Cal., was destroyed by snow slides, which tore away the station and a portion of the transmission lines, causing death or injury to several people. This plant, which supplies electrical energy to several cities and mining camps in southern Nevada, has now been completely restored.

British Columbia 15,000-hp Hydroelectric Development.—The Prince Rupert Hydroelectric Company has been incorporated with a capital of $5,500,000 to develop 15,000 hp on the Okeena River, British Columbia, and branches, for transmission to Prince Rupert, about 42 miles distant. Work will be begun at once on a provisional 1500-hp plant. The company has been organized by interests connected with the Western Canada Power Company, of British Columbia, and includes among its incorporators Mr. R. F. Hayward, general manager of the latter company, and Prof. L. A. Herdt, of McGill University.

Reconstruction of Colorado River Dam at Austin, Tex.—Two propositions for the reconstruction of the large dam across the Colorado River at Austin, Tex., are under consideration by the City Council of that city. One is from the J. F. Cogan Company, of New York, and the other was submitted by the Hydraulic Properties Company, of the same city. The water-power is to be utilized to generate electrical energy. In one case all of the energy is to belong to the city; in the other about 25 per cent is to go to the city, the remainder to be sold by the company for a term of twenty-six years. The proposition accepted tentatively by the City Council will be submitted to popular vote.

Hydroelectric Project Near Santa Rosalia, Mexico.—Contrary to recent reports, the Mexico Northern Power Company has not abandoned its plan for the construction of a hydroelectric development on the Conchas River at a point about 18 miles from Santa Rosalia, in the State of Chihuahua. While the work of building the dam was interfered with to some extent on account of recent revolutionary troubles, the force of laborers will be increased at once with a view of making up for lost time. From the generating plant transmission lines will be construction to the cities of Chihuahua, Parral, Jimenez, Santa Rosalia and a number of the larger mining camps. The initial cost of the enterprise will be about $5,000,000 in gold, it is said. It is reported that mines and other industrial concerns have already contracted for the use of about 50,000 hp in electrical energy. The company is composed of a small group of Canadian capitalists.

Texas Attorney-General Investigating Alleged Electrical Trust.—The joint resolution adopted by the Legislature of Texas at its recent session calling on the Attorney-General to investigate the so-called electrical trust that is alleged to be doing business in Texas and to institute prosecutions against its members, should he find that the reports of its existence are well founded, is now being observed by Attorney-General J. P. Lightfoot. In company with Assistant Attorney-General John W. Brady, Mr. Lightfoot is visiting a number of cities for the purpose of investigating different companies that are doing business in Texas. The resolution requires that he shall investigate the books and affairs of the Bell Telephone Company, the Southwestern Telegraph & Telephone Company, the United States Electric Company, the General Electric Company, the Western Union Telegraph Company, the Postal Telegraph Cable Company, the Stone & Webster syndicate and the various subsidiary concerns of these respective corporations.

Central-Station Development.—With the title "The Commercial Development of the Electric Light and Power Industry," the Electric Bond & Share Company has issued an interesting pamphlet prepared by Mr. Edward B. Lee, statistician of the company. The greater portion of the text consists of a comparison and discussion of statistics from the United States central-station census reports for 1902 and 1907. An estimate is given of the outstanding bonds and stock of central-station companies in 1911, the total being $1,788,075,452, an increase of 284.9 per cent over the census figures of 1902. A partial list is given of transmission companies operating 100 miles or over of high-tenson lines. Twenty-one companies are mentioned, of which five operate at 100,000 volts and one (Commonwealth Power Company, Michigan) at 110,000 volts. One of the companies (Pacific Gas & Electric Company) has now approximately 1000 miles of high-tension line.

Opening of New Northwestern Railroad Station, Chicago.—The new Chicago Passenger Terminal of the Chicago & Northwestern Railroad, just completed at a cost of $24,000,000, was thrown open to the public Sunday, June 3. A very full preliminary illustrated account of the electrical features of this station was given in the *Electrical World* July 8, 1909. The building is a monumental structure of granite and marble, 320 ft. x 218 ft. in plan, and contains ten acres of floor space. The exterior is designed in the Italian Renaissance style of architecture, with a Doric portico of six 60-ft. granite columns. The terminal has its own lighting and power plant, with cross-compound engines exhausting into low-pressure steam turbines. This equipment furnishes energy for twenty-four elevators for passengers, baggage, mail, etc.; a pneumatic tube system, ventilating blowers, belt conveyors, station lighting, yard lighting, curb-post illumination, etc. A total of 780 hp in motors is installed in the building. The switching of trains in the thirty-acre yards is controlled by a complete system of electric interlocking signals. Nearly 75,000 cp in incandescent lamps is said to be employed in the indirect illumination of the main waiting-room.

Cincinnati Accident Causes Picturesque Reporting.—Lightning struck a portion of the Plum Street plant of the Union Gas & Electric Company in Cincinnati on May 30 and did considerable damage. The opportunity for some rather sensational writing was not overlooked by the Cincinnati reporters. Thus we are told that "Fire that no water could extinguish burned into the very vitals of the plant, fried and roasted the thick insulations of the giant feed wire, and in a few moments the entire city, along with West Cincinnati, was shrouded in Stygian darkness." There are references to "wiring from a thread size to diameters similar to sewer piping," to "machinery growling under the heat," and so forth, to the extent of a column and a half. It is also neatly stated that, in ordinary course, the lightning would have been "quickly absorbed by superior electric power." In the same article Mr. Rollin W. White, acting president of the company, was interviewed, and, if correctly reported, gave the facts as follows: "This is one of the most remarkable accidents that have ever happened to the Cincinnati plant, and it is also a very rare one. A bolt of lightning struck the building and made its way to one of the big transformer tubs. It fractured the transformer casing, allowing the oil to run over the floor. The oil ignited and burned out two cable leads, as well as throwing the whole plant into confusion. As soon as the fire was quenched repairs were begun. The damage was very slight so far as machinery and plant are concerned, being confined to the transformer and the burned cable, and will hardly run over $500. The accident threw the whole plant out of service for half an hour or more."

A CLIFFSIDE STEAM-TURBINE PLANT.

Northern Heating & Electric Company's Station in St. Paul, and Its Sand-Rock Distributing Tunnels.

NATURAL conditions often make it necessary to depart from the commonly accepted ground-plan arrangement of the various operating elements in power plants. Stations built on hillsides may secure certain advantageous vertical positioning of parts not possible or advisable under the limits of a flat foundation.

A plant embodying the vertical idea of arrangement to a unique degree is the 4300-kw steam-turbine station of the Northern Heating & Electric Company, at St. Paul, Minn. This is virtually an eight-story building standing on the river shore against a high cliff, so that its sixth story, on which the company offices are located, is at the level of the city sidewalks.

Beginning at the bottom, below the level of the tracks outside is the coal-receiving apparatus. Above this are the boilers. The extension, seen in Fig. 3, has just been added. The three-story portion of the front of the plant which extends above the upper street level is faced with red brick and bears the general appearance of a prosperous business building, giving no suggestion of the complex mechanical and electrical equipment within. As the main furnaces are worked with induced draft, even the short smokestack is hardly noticeable above the roof of the building.

STEAM EQUIPMENT.

Coal is brought into the plant on a spur track at the river level from the lines of the principal railroads entering St. Paul, all of which pass the station. From the cars it is dumped into a track hopper, Fig. 2, and passed through a crusher driven by a 15-hp, 220-volt alternating-current motor. From this a drag conveyor, operated by a 5.5-hp motor, raises and dumps the coal into the main bucket conveyor, which in turn elevates it to the bunkers 120 ft. overhead. This Peck carrier is made up of 182 24-in. buckets 18 in. wide and is driven by a 15-hp motor. After raising the coal 120 ft. to the overhead horizontal run the buck-

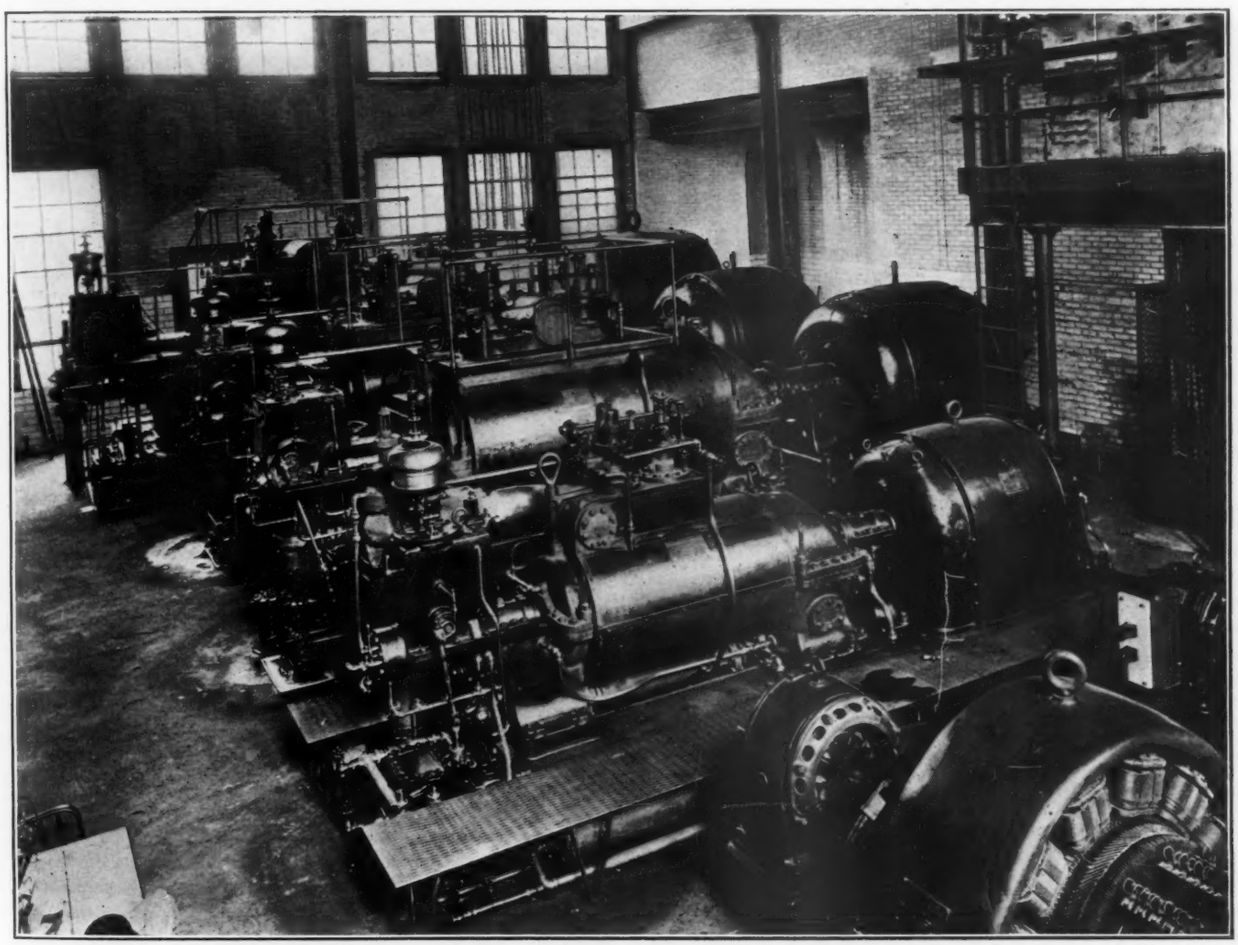


Fig. 1—Turbo-Generator Room of Northern Electric & Heating Company, St. Paul.

turbine-room occupies the third and fourth-floor levels, its switchboard being at the fourth story. A machine shop is on the fifth, the general offices on the sixth, the engineering offices on the seventh and a storeroom on the eighth. As shown by the sectional elevation, Fig. 2, however, the major part of the building's interior, from the third to the eighth stories, is occupied by the economizer chambers and by the huge coal bunkers.

The building, a steel-frame structure with brick walls, measures 143 ft. x 75 ft. in floor plan and has an extreme height of 145 ft. from the foundation of the coal-crusher room to the eaves of the roof. To the main building a 37-ft. x 30-ft. boiler

ets strike a tipple, which can be set to discharge them into any of the three great coal-storage bins.

The overhead coal bunkers are 84 ft. long, 58 ft. wide and 62 ft. deep, and altogether are capable of holding 4500 tons at one time. The sides are of arched steel plates, while the ends and inclined surfaces are of heavy reinforced concrete supported by steel framing. The bunkers are divided into three bins by steel partitions, each bin feeding a pair of boilers beneath it, while No. 3 bin supplies, in addition, the new pair of 500-hp boilers in the newly erected boiler-room extension. The coal used in this plant is Youghiogheny and Hocking screenings,

costing $3.15 per ton delivered in car-load lots. In case of fire in the bunkers, or if for any other reason it becomes necessary to transfer coal from one bin to another, telescope chutes are provided from the bunkers, discharging through manholes in the boiler-room floor to the conveyor buckets beneath.

Beneath the coal bunkers are six 600-hp Edge Moor water-tube boilers, and in the new addition at the west of the building are two 500-hp boilers of the same type. Five of the original battery of 600-hp boilers are equipped with Murphy automatic stokers, the sixth boiler having a Model stoker. The new 1000-hp battery is equipped with Green chain grates and Foster superheaters. All coal fed into the furnaces is first weighed or measured in overhead hoppers. In this way a close record is kept of the coal burned. The ashes dropped from the furnaces are collected in hoppers in the basement and discharged into the Peck conveyor already mentioned. This elevates the ashes to the 120-ft. level, as in the case of the coal, dumping them by means of an adjustable tipple into a cylindrical steel ash bin. The bin has a capacity of two carloads and extends downward through the lower floors of the building, discharging into the cars on the track below.

From the furnaces of the six older boilers the flue gases pass upward through asbestos-covered uptakes (conducing to a low temperature in the boiler-room) to the economizer chambers on the floor above. Here the gases give up a large part of their heat, being reduced in temperature to about 350 deg. Fahr. to 380 deg. Fahr. The draft on these boilers is induced mechanically by two 16-ft. x 5-ft. fans driven at 100 r.p.m. by Ball engines. The draft over the grates averages a pressure equal to 0.3 in. of water column. From the fans the flue gases are discharged into the atmosphere by a 9-ft. 6-in. steel stack, 101 ft. in height over the boilers and extending a few feet above the roof of the building. The fan engines are lubricated by a forced-feed oiling system, the necessary pressure being supplied by a water column tapped from the condensate of a steam line. One man is charged with filling the oil reservoir weekly, although the tank holds a two weeks' supply, insuring that the engines shall be always well lubricated. The bearings of the flue-gas fans are lubricated with a solid oil which is forced into the heated bearings by home-made but effective screw-thread syringe arrangements, to the handles of which is given a half-turn every few hours.

Feed water for the boilers is diverted into a tank in the basement from the jet-condenser discharge line, water from the nearby Mississippi River being used for condenser cooling purposes. From the basement tank the feed water passes through the Green economizers, each set comprising 280 4-in. tubes 10 ft. in length. Tests made on these boiler units with the water in the tank at 40 deg. Fahr. have shown the water leaving the economizers to be at from 125 deg. to 150 deg., the flue-gas temperature having been meanwhile reduced to about 350 deg. A pressure of 185 lb. per square inch is carried on the boilers, and the tests already cited have shown that under ordinary operating conditions the boilers evaporate about 7.1 lb. of water per pound of coal. Drain valves from the water columns on the boilers over the Dutch ovens are mounted within reaching distance from the floor, so that the columns can be drawn off easily every hour. The boilers are blown off once in each eight-hour watch. On the boiler-room floor are a Knowles boiler-feed pump, a Worthington low-service pump and a Blake pump. In the basement below are a Smith-Vaille boiler-feed pump, a Smith-Vaille low-service pump and a Dean pump.

All of these boiler-feed pumps are arranged with double-pipe inlet and discharge piping, one inlet pipe coming from the heater and the other from the cold-water tank. In case the feed water becomes overheated in the economizers, producing steam vapor which the feed pumps will not handle, a little cold water has only to be turned into the inlet by adjusting one of the two valves. The lines are also duplicated from the pumps to the boilers. The steam taken from the old boilers is led through ten dry pipes in each, effectually drying and superheating it. The large headers from the boiler-room to the turbines over-

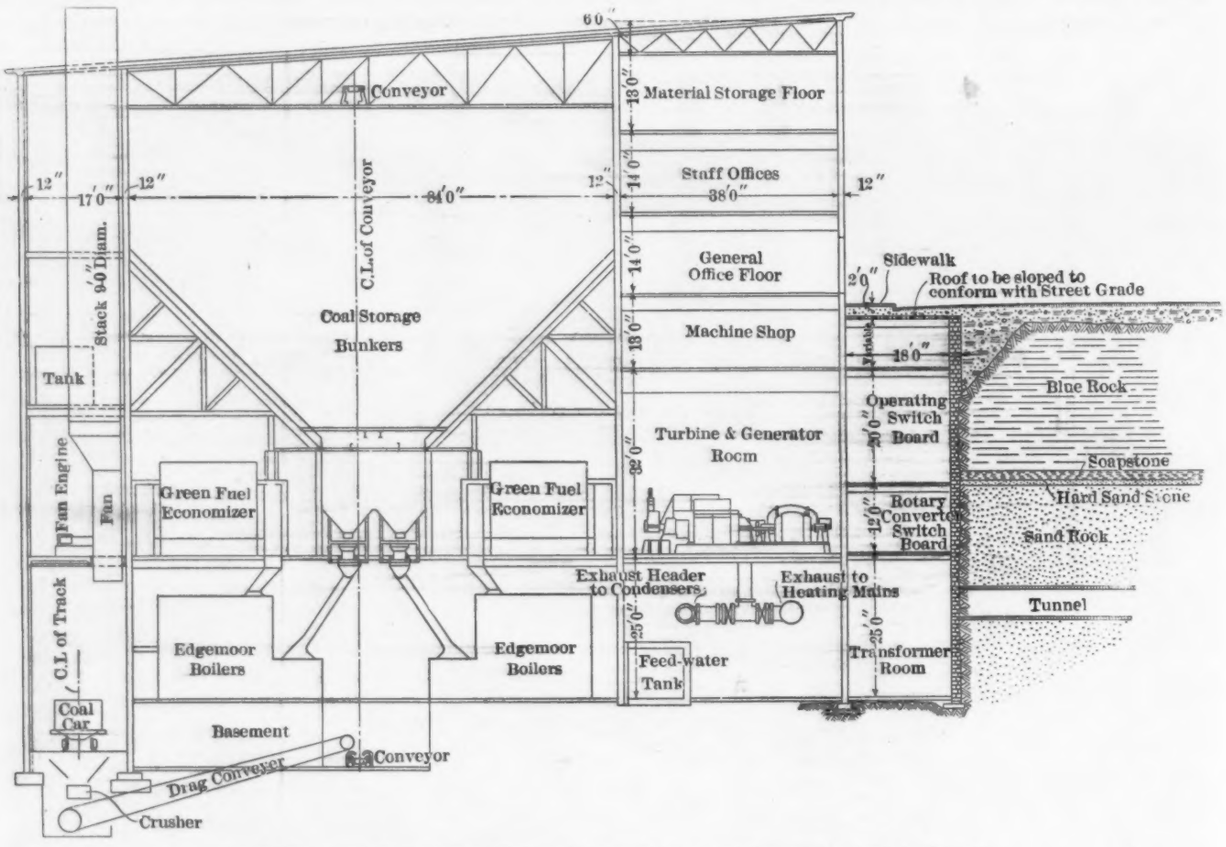


Fig. 2—Sectional Elevation of Power House, Showing Cliff and Sand-Rock Tunnels.

head are arranged for sectionalizing so that any boiler or boilers can be cut out for cleaning or repair.

The new boiler equipment installed in the west addition will enable the six main boilers to be shut down during the three summer months when there is no steam-heating load to be carried. As before noted, the new pair of 500-hp boilers are equipped with Foster superheaters. The flues open into a 6-ft.

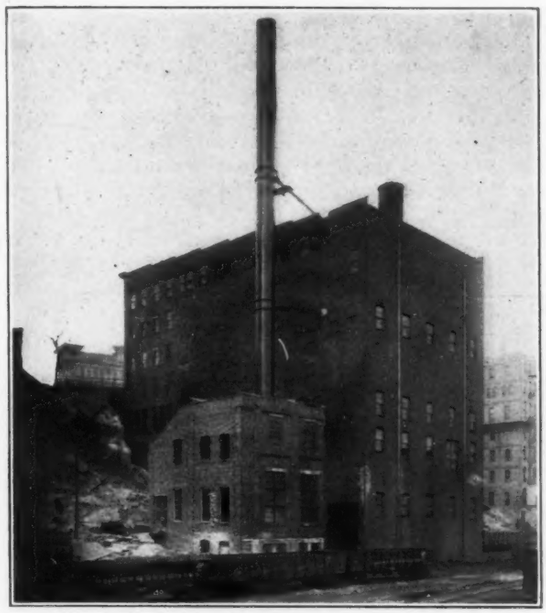


Fig. 3—Generating Station of Northern Electric & Heating Company, St. Paul.

6-in. steel stack, 150 ft. high above the boilers, and providing its own natural draft. Together with this new boiler equipment there has also been installed a 700-hp Stillwell open feed-water heater, utilizing the exhausts from the plant auxiliaries and the drains from the main steam lines. The new feed-water heater will be used in conjunction with all eight boilers, the flue-gas economizers being employed to raise the feed-water temperature even higher than that at which it leaves the heater.

ELECTRICAL GENERATING APPARATUS.

The turbine-room, Fig. 1, on the floor level above the boiler-room contains 4300 kw in horizontal, high-pressure steam turbines driving Westinghouse 2300-volt, 60-cycle, three-phase alternators. There is one 2000-kw unit, two of 1000-kw rating each and one of 300-kw rating. The excitation of these alternators can be furnished from either a 40-kw or 25-kw, 2300-volt motor-generator set or for starting by a 30-kw direct-connected steam-engine unit in the basement. In addition to the prime

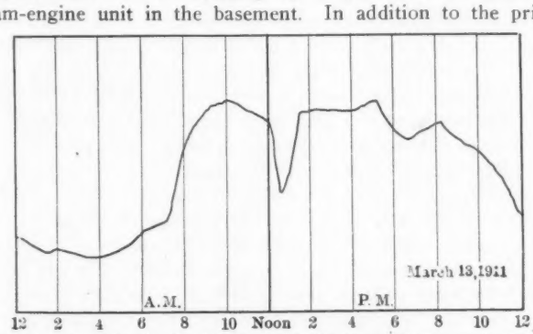


Fig. 4—Typical Daily Load-Curve at Northern Company's Generating Station.

movers on the generator-room floor there are also a 300-kw and a 150-kw rotary converter delivering 220-volt direct current for the use of direct-current customers near the plant. Across the leads of these machines a 7.5-kw balancer set can be operated, giving a neutral point from which to bring out the middle wire of the 220-110-volt three-wire circuit used.

The huge exhaust lines from the steam turbines are arranged with valves so that any unit can be connected to exhaust into either the condensers or the low-pressure steam-heating system which serves the business district of the city in the neighborhood of the plant. The condensers are of the Baragwanath barometric jet type and are supplied with cooling water from the Mississippi River by two 50-hp motor-driven centrifugal pumps, each capable of delivering 2200 gal. per minute against a head of 40 ft. These pumping units in addition to a spare unit supplied for emergency are installed in a pump house at the brink of the river near the plant. As has been already noted, the boiler-feed water supply is taken from the discharge of the condensers.

The steam-heating system into which the turbines are ex-

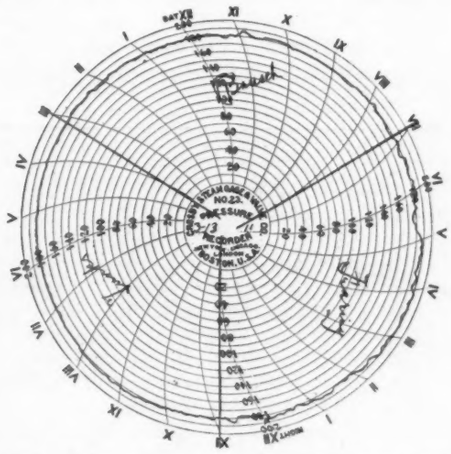


Fig. 5—Steam-Pressure Record Chart Marked by Shifts for Bonus Award.

hausted eight months in the year presents a normal back-pressure of from 4 lb. to 8 lb. per square inch at the station end of the mains. From June 15 to Sept. 1 only are these turbines run condensing, and during this time they gain the thermal efficiency of exhausting into a vacuum equal to 25 in. of mercury column. Running as a purely electrical plant during the summer season the coal consumption per kw-hour has been as low as 4 lb., but, as explained, during the major part of the year, on account of the Northern climate, the greatest part of the coal burned in the boilers is for the supply of the steam-heating consumers. The electrical load on the station, which is

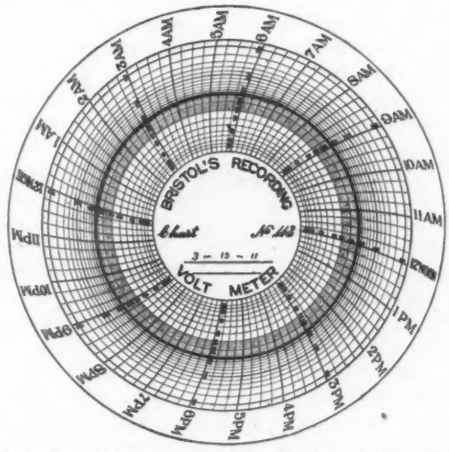


Fig. 6—Recording Voltmeter Record, Showing Voltage Regulation at Switchboard.

to a large extent commercial-motor business, continues nearly constant during the year. A sample load curve is shown in Fig. 4. During an average winter month from 4000 tons to 5200 tons of coal is burned, while the summer consumption barely reaches 1500 tons per month. The difference between these figures gives some estimate of the water evaporated purely

for steam-heating purposes. This during certain months has reached 60,000,000,000 lb.

The personnel of a plant force and the treatment which is accorded employees are not small factors in the successful operation of a station. Three eight-hour shifts are now employed in the Northern company's station. The men appreciate the reduced strain thus placed upon them, and are in better condition for working the shorter hours. A system of bonus awards is also in effect among the firemen, which conduces to keeping a nearly perfect steam curve. The cards taken from the recording-pressure gage are divided into three eight-hour segments, as shown in Fig. 5, corresponding to the three shifts of firemen employed. The fireman having the best pressure line during the preceding two weeks gets a bonus or cash prize of $5. Penalties are, of course, adjudged for allowing water to come over, for holes in the fire, etc., and a carbon-dioxide recorder is to be attached to the stack, making it possible to detect irregularities in the firing at any time. The comfort of the men in the fireroom is also enhanced by the asbestos insulation of the flue uptakes, the provision of draw-off pipes from the water columns and other minor details, mentioned in the foregoing.

The operation of the electrical equipment is controlled from a switchboard gallery, 36 ft. x 10 ft., mounted to overlook the turbine-room. Besides the standard machine panels and instruments with which the gray marble board is equipped there are also a Tirrill voltage regulator, a Bristol recording voltmeter, a Westinghouse recording wattmeter, static ground detectors, power-factor meters, totalizing watthour meter and a synchroscope. Oil switches are provided for controlling the various feeders which go out of the station. A sample voltage regulation chart is shown in Fig. 6, illustrating the close regulation obtained.

DISTRIBUTION LINES AND SAND-ROCK TUNNELS.

The principal part of the station output is transmitted at the generator pressure, 2300 volts. As before explained, however, there is 450 kw of transformers and rotary converters, the 110-220-volt direct-current output of which is used in the district near the plant. There is also a 6600-volt transmission from the generating station to the Merriam Park substation, seven miles distant, duplicate lines being provided. One follows the river bank on pole-line construction; the other goes underground through the tunnels, emerging at a distant point and then taking to overhead construction.

Before describing the underground distribution system something should be said of the peculiar geological formation on which the business part of St. Paul is situated. The surface material, after cutting below a foot or two of soil, is of a flinty "blue rock" or limestone, which is nearly as difficult to excavate as the hardest granite or gneiss. This extremely hard rock extends down for a depth of 25 ft., although varying, of course, in different parts of the city. But at approximately this depth, as shown in Fig. 2, the formation undergoes a sudden change, and, below comparatively thin strata of soapstone and hard sandstone, there is a soft sand rock through which tunneling is easy. The formations described belong to the Silurian period of the earth's geological history, and the varying materials passed in order represent changes that occurred during forgotten ages in the ocean currents and conditions along the old sea bottoms which formed the present rocks of Ramsey County.

Advantage has been taken of the presence of the soft sandstone substratum to construct great galleries of underground tunnels for the use of the various public utilities of St. Paul, including the electric companies, telephone companies, waterworks and sewers. The tunnel system of the Northern Electric & Heating Company, which branches from the main raceway leading from the plant, comprises a total of about 8000 lin. ft. of tunnel, 6 ft. high and 3 ft. wide, through which electric cables and steam-heating mains are carried. Fig. 7 shows a map of these tunnels. At distribution points in the underground system transformers are mounted in chambers hollowed out of the sand rock at the side of the tunnels, and from these points the low-tension and the 2300-volt cables rise, through shaft holes drilled in the upper blue rock, to the surface or to the cellars of the buildings served. The sand-rock tunnels of the Northern company average in depth 25 ft. to 40 ft. below the surface. The sandstone is quite hard when first exposed and has to be excavated with pick and shovel, one man being able to advance a 6-ft. x 3-ft. heading about 2 ft. per day. The drill holes leading from the tunnels to the surface are 4 in. to 6 in. in diameter.

Through the main tunnel, shown in Fig. 8, are carried ten three-conductor alternating-current cables, one pair of single-conductor direct-current cables, a 20-in. and a 16-in. low-pressure steam-heating main, and a 5-in. live-steam pipe, the latter carrying steam for cooking in the Hotel St. Paul kitchens, several blocks from the plant.

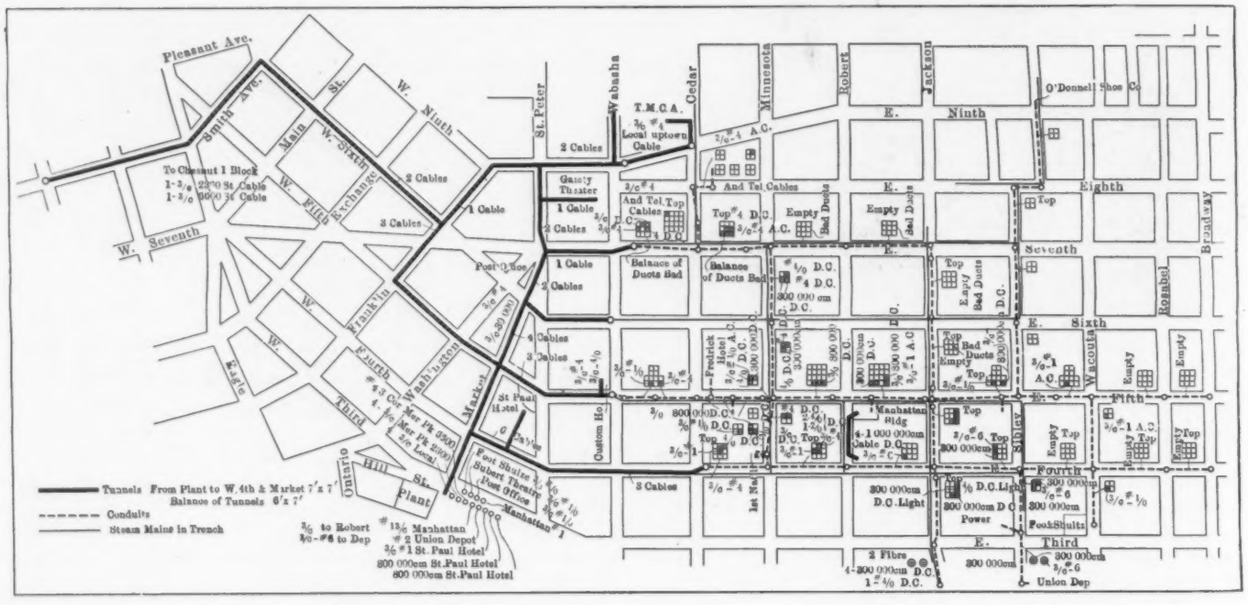


Fig. 7—Map of Northern Electric Company's Sand-Rock Tunnels, Conduits and Steam Lines Under Business Section of St. Paul.

All service to this splendid modern hotel, including lighting, power, heating and steam for cooking, is furnished by the Northern company. The 800,000-circ. mil, 220-volt direct-current circuit above mentioned operates the electric elevators in the St. Paul Hotel, besides serving the 130-kw lighting and

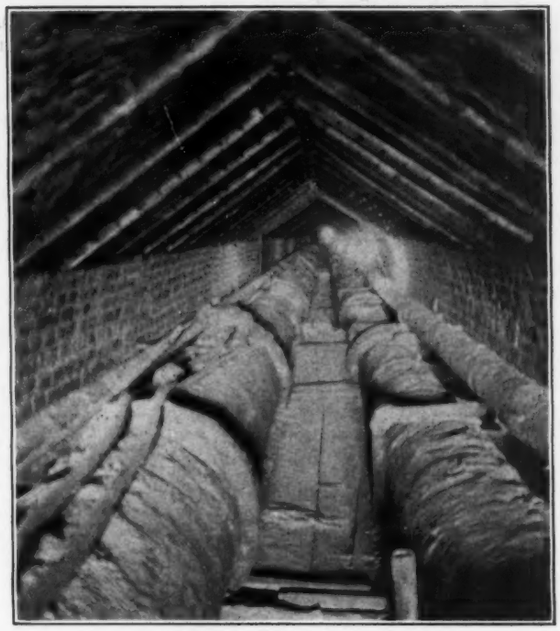


Fig. 8—Main Sand-Rock Tunnel, Showing Steam Pipes and Cable Brackets.

motor load of the federal buildings near by. Alternating-current energy for lighting and motor purposes in the hotel is delivered at 2300 volts to three 125-kw transformers in a concrete compartment in the hotel basement and there reduced to 110 volts. The transformer chamber is force-ventilated by special pipes from the open air to the floor of the vault, and the transformers are equipped with switches so arranged that in case of breakdown any one can be removed from circuit and the remaining two operated on open-delta. A complete distribution switchboard is mounted in the sub-basement, outside the transformer cell. The connected load of the hotel represents 200 kw in incandescent lamps, the majority of which are tungstens, and 272 hp in motors. The latter are used to operate the elevators, hoists, a fifteen-ton ice machine, circulating pumps, vacuum cleaner, ice crusher, dish-washers, silver polishers, electric irons and laundry washers and mangles, all being alternating-current service except the elevators. The West Publishing Company, whose plant is near the station, also has a direct-current load amounting to 188 hp, which is supplied from the rotary converters in the main station.

In the main tunnel the cables are carried on A-frame brackets mounted overhead as shown. Three of the alternating-current, three-conductor cables are made up of No. 0 cross-section, the remainder being of No. 4 copper. Three of these cables feed the Manhattan substation, at Robert and Fifth Streets, where are installed two 400-kw motor-generators, producing 110-220-volt direct current for the district bounded by Wabasha, Seventh, Wacuta and Second Streets. A 6600-volt cable, which also traverses the tunnel, is used as an auxiliary line to the 6600-volt overhead pole-line construction leading northwest along the river bank to the Merriam Park transformer substation, seven and one-half miles distant, which serves a residence section. Lightning arresters are provided on the next poles, where the overhead lines enter the tunnels at the borders of the underground district.

There is also a 6600-volt line leading across the river, a distance of eight miles, to a substation in South St. Paul. This substation serves a capacity of about 500 kw in street and commercial lights and power.

Besides those above mentioned other large consumers of the Northern Electric Company are the Central Warehouse Lumber Company, with 235 hp; Foot-Schulze Shoe Company, 153 hp; Shubert Theater, 100 kw; Union Station, 100 kw; Y. M. C. A.; Auditorium; Farwell, Ozman, Kirk & Company; Raudenbush Piano Company, and the Frederick and McGee hotels.

The 331,000 sq. ft. of radiation of the 225 steam heating customers are served by a total of 20,000 ft., or nearly four miles, of low-pressure steam mains. All heating service is measured by condensation meters, the rate being $0.50 to $0.80 per 1000 lb.

The Northern Heating & Electric Company is operated by H. M. Byllesby & Company, Chicago, Mr. Eugene Holcomb being general manager at St. Paul. Mr. J. L. Lawrence is chief engineer of the power plant.

THE COLORADO RIVER POWER COMPANY.

At Marble Falls on the Colorado River, in central Texas, there is approaching completion the first hydroelectric development of the Colorado River Power Company, whose future plants at Cummins and Smithwick Falls will ultimately make up a 20,000-hp system which is to transmit energy at 66,000 volts to Austin, Temple, Waco, San Antonio and other points in the central part of the State.

The Marble Falls dam, which will be the first to be completed, comprises an immediate development of 1650 hp—later to be increased to 9650 hp—utilizing a 70-ft. head in the Colorado River. With the storage area of 116,000 acre-ft. impounded by an 80-ft. dam across the San Saba River, 90 miles above the Marble Falls dam, a minimum constant flow of 740 cu. ft. per second is assured. The power dam is of the concrete compartment type, and measures over all 748 ft. at the top and 700 ft. along the base, which rests on a shelf of hard limestone. The masonry spillway section rises to a height of 65 ft., above which is 5 ft. of mechanically operated flashboard extending the full width of the spillway, 400 ft. This movable crest is built in 10-ft. sections, the frames being made of structural steel covered with 3-in. lumber and secured by heavy hinges. All joints are made watertight by strips of heavy six-ply rubber belting.

The buttresses of the spillway section are spaced at 10-ft.

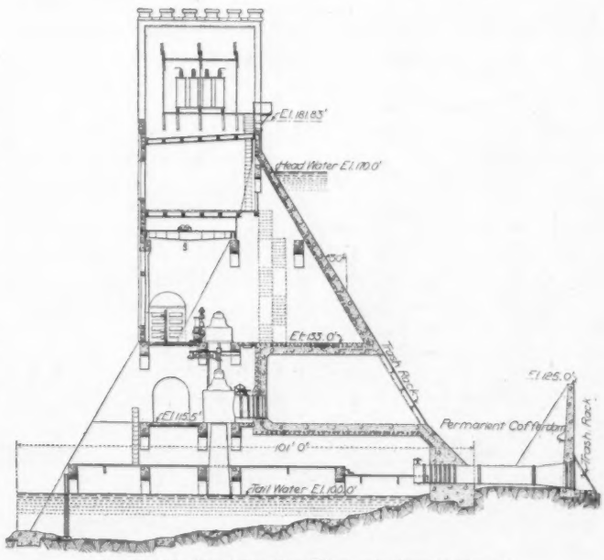


Fig. 1—Vertical Section Through Power House.

distances and those in the power-house section 14.5 ft. apart. The thirty-five sluice gates, each 7½ ft. x 8 ft., are built up of 9-in. channels reinforced by I-beams and covered with ⅜-in. steel plate. The gates are operated, one at a time, by a hydraulic cylinder mounted on a car on a transfer track extend-

ing the full length of the sluice-gate section. This cylinder is supplied with water pressure to manipulate the gate by an electrically driven triplex pump delivering 2000-lb. pressure per square inch. In case of flood the sluicegates will first be operated and then any part, or all, of the movable crest can be lowered. The maximum flood recorded in the river has been 200,000 cu. ft. per second. Each of the 7.5-ft. x 8-ft. gates can discharge 5000 cu. ft. per second, so that the quantity remaining to be spilled over the crest is small.

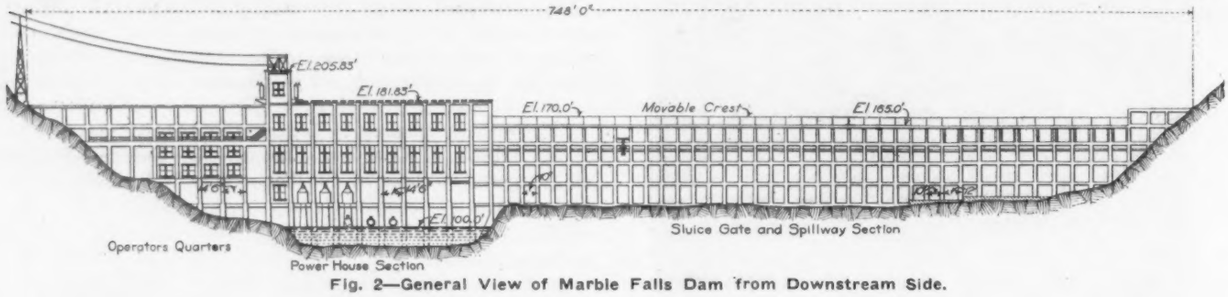


Fig. 2—General View of Marble Falls Dam from Downstream Side.

The power-house section of the dam structure is built to a height above any possible high water, the maximum height from the foundations to the top of the transmission-entry tower being 115 ft. The generating equipment to be installed at once comprises three 550-hp Victor vertical waterwheels direct-connected to 350-kw Westinghouse 2300-volt, 60-cycle, three-phase alternators. Each waterwheel unit will be equipped with a Lombard A6 oil governor. The present units occupy three of the nine compartments making up the power house, the other bays, except one, providing for the installation of future 2200-hp units. The ninth bay or compartment will contain the high-tension transformers and switching apparatus, the energy being raised for transmission to 66,000 volts. The present plans contemplate using wooden-pole line construction, eventually installing duplicate lines to the Round Rock junction and switching point.

A unique feature in the construction of the Marble Falls dam is the "dry-dock" provision of a concrete cofferdam extending along the crest of the natural fall for the purpose of diverting the flow of the river through the sluicegates during construction as well as later when making repairs or inspection of the power-plant section of the dam. Three 48-in. steel tubes extend through this permanent cofferdam toward the power-house section and through the concrete bulkhead, terminating in the discharge pits at an elevation slightly above tailwater. Swivel gate valves in these pipes make it possible, after drawing the water down in the pond, to divert the entire ordinary flow of the river through the tubes, so lowering the water in the pond as to expose the gate section of the dam. The space between the cofferdam and the power house can also be drained, exposing the upstream side of the power-house bulkhead and foundations. Through tailgates water can be pumped from any compartment, enabling any of the foundations of the structure exposed to be easily repaired or inspected.

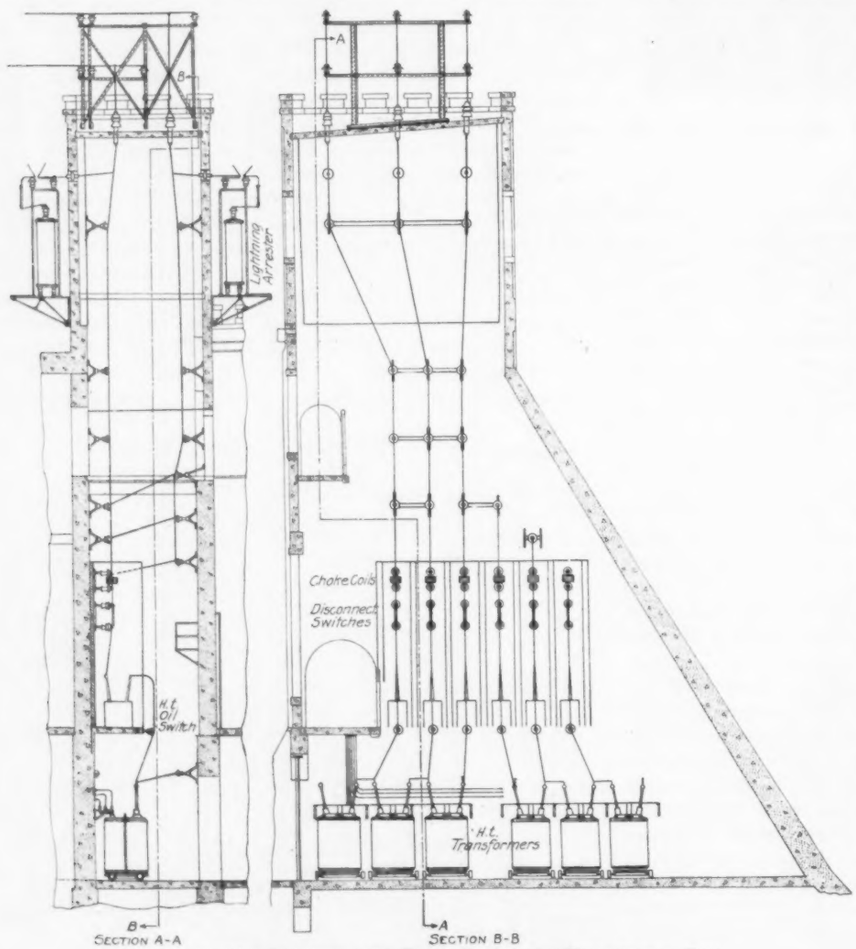


Fig. 3—Section Through Line Entry Tower and Transformer Bay.

The largest part of the power developed by the Colorado River system of hydroelectric developments will probably be sold at wholesale to large consumers, a part having already been contracted for. On account of the high cost of fuel in the district reached by the water-power lines, it is expected to find a good market for secondary power to consumers now having steam plants, a reciprocal agreement being made with these plant owners by which their surplus steam power may be absorbed by the water-power system in case of low water. Besides the power transmitted to the larger centers like Waco, Austin and San Antonio, some power will be used locally at Marble Falls and at points on the route of the transmission line.

The San Sabe 80-ft. storage dam, 90 miles above the Marble Falls dam, will be arranged for the installation of future power units. The Cummins dam, 10 miles above the Marble Falls site, is now marked by a 7-ft. dam, which will be replaced by a reinforced-concrete dam similar to that at the lower site and creating a 47-ft. head. The Smithwick Falls site, 12 miles below the present site, will produce a 50-ft. head when built.

From the group of water-power plants a transmission line will be taken 40 miles southeast-by-east to a switching station near Austin, from which point runs a 110-mile line northeasterly to Waco, and an 80-mile line southwest to Austin. The Marble Falls plant will thus be required to transmit over a maximum distance of 130 miles in transmitting energy to Waco.

Mr. C. H. Alexander, of Dallas, Tex., is president of the Colorado River Power Company. The W. H. Zimmerman Company, engineer and constructor, Chicago, has acted as engineer for the Marble Falls development during its design and construction.

POWER-FACTORS AND STARTING CURRENTS.

In a paper presented by Mr. F. D. Newbury at the recent N. E. L. A. convention a table was given of the power-factors of various kinds of central-station loads and another of alternating-current starting currents, both of which are reprinted below.

Incandescent lighting with small lowering transformers.—Power-factor, 90 per cent to 95 per cent.

Alternating-current inclosed-arc lamps with constant-current transformers.—Power-factor, from 60 per cent to 75 per cent, depending upon whether the transformers are carrying their rated number of lamps. An average figure would be 70 per cent.

Direct-current metallic-arc lamps with rectifiers.—Power-factor, from 55 per cent to 70 per cent, depending upon whether the rectifiers are carrying their rated number of lamps. An average figure would be 65 per cent.

Single-phase induction motor, squirrel-cage rotor, 1/20 hp to 1 hp.—Power-factor, 55 per cent to 75 per cent, average 68 per cent, at rated load.

Single-phase induction motors, squirrel-cage rotor, 1 hp to 10 hp.—Power-factor, 75 per cent to 86 per cent, average 82 per cent, at rated load.

Polyphase induction motors, squirrel-cage rotor, 1 hp to 10 hp.—Power-factor, 75 per cent to 91 per cent, average 85 per cent, at rated load.

Polyphase induction motors, squirrel-cage rotor, 10 hp to 50 hp.—Power-factor, 85 per cent to 92 per cent, average 89 per cent, at rated load.

Polyphase induction motors, phase-wound rotors, 5 hp to 20 hp.—Power-factor, 80 per cent to 89 per cent, average 86 per cent, at rated load.

Polyphase induction motors, phase-wound rotors, 20 hp to 100 hp.—Power-factor, 82 per cent to 90 per cent, average 87 per cent, at rated load.

Induction motor loads in general.—Power-factor, from 60 per cent to 85 per cent, depending on whether motors are carrying their rated loads.

Rotary converters, compound wound.—Power-factor, at full load can be adjusted to practically 100 per cent. At light loads it will be lagging, and at overloads slightly leading.

Rotary converters, shunt wound.—The power-factor can be adjusted to any desired value, and will be fairly constant at all loads with the same field rheostat adjustment. Rotary converters, however, should not be operated below 95 per cent power-factor leading or lagging at full load or overload.

Small heating apparatus.—This load has the same characteristics as an incandescent-lighting load. The power-factor of the load unit is practically unity, but the distributing transformers will lower it to some extent.

Arc furnaces.—Power-factor, 80 per cent to 90 per cent.

Induction furnaces.—Power-factor, 60 per cent to 70 per cent.

Electric-welding transformers.—Power-factor, 50 per cent to 70 per cent.

Synchronous motors.—Adjustment between practically zero power-factor leading to zero power-factor lagging.

The author made the following general statements regarding probable power-factors: (1) Operating power-factors above 95 per cent will be obtained only when practically all of the load is synchronous motors or converters which may be operated at practically unity power-factor. Even with this character of load the generators should be capable of operating satisfactorily at 93 per cent power-factor to provide for unforeseen contingencies. (2) Power-factors of 90 per cent to 95 per cent can be safely predicted only when the load is entirely incandescent lighting or heating, or if a large non-inductive load, such as synchronous motors or converters, is used with a smaller proportion of inductive motor load. (3) For the average central-station load, consisting of lighting and motor service, a power-factor of 80 per cent should be assumed. (4) A power-factor of 70 per cent should be assumed for a plant having a large proportion of induction motors, arc lighting, electric furnaces or electric welding load.

In what follows the starting torque is expressed in terms of the full-load torque, and the starting current in terms of the full-load current. The smaller values given for synchronous motors cover the requirements of motor-generator sets and air compressors and pumps when the apparatus can be started without load. The larger values refer to motors for driving pumps and fans, which must be started under practically full-load conditions. The wide variation in the starting current comes from differences in construction of the motor or differences in the proportions of the motor, since, by increasing the size and cost of synchronous motors, the starting performances can be materially improved.

Single-phase induction motors, with clutch, split-phase starter.—Starting torque, 1 to 1¼, starting current, 4½ to 6.

Single-phase induction motors, without clutch, split-phase starter.—Starting torque, 2; starting current, 3½ to 4½.

Polyphase induction motors, cage-wound type, auto-transformer starter.—Starting torque, 2; starting current, 7 to 8.

Polyphase induction motors, wound-rotor type, step-by-step resistance starter.—Starting torque, 1; starting current, 1¼. Starting torque, 2; starting current, 2½.

Synchronous motors, auto-transformer starter.—Starting torque, 0.3 to 0.5; starting current, 1½ to 2½. Starting torque, 0.7 to 1; starting current, 4 to 8.

Rotary converters, auto-transformer starter.—Starting torque, 0.2; starting current, 1½. Starting torque, sufficient to start itself.

REASONS FOR COOLING TOWERS ON ISLAND POWER HOUSES.

Engineers visiting Galveston, Tex., often express surprise to find cooling towers in use on local power plants, although Galveston is situated on an island in the Gulf of Mexico with plenty of circulating water available on all sides. The Brush Electric Light & Power Company of Galveston has probably the largest cooling tower in the South, an open, wooden-tray structure, 30 ft. wide, 150 ft. long and 28 ft. high. The tower is situated over two large reservoirs, and was designed to require the minimum pumping lift for the water. A vacuum of 26½ in. to 28 in. of mercury is maintained on the 4300-kw turbine plant, which the tower serves, the water being cooled from 120 deg. down to 80 deg. to 90 deg. Fahr. in its passage through the trays.

Attempts to use ocean water with surface condensers have failed at Galveston on account of the activity of submarine life in the waters of the Gulf of Mexico. In spite of any straining devices that could be employed eggs and germs of barnacles and shellfish were admitted to the intake pipes and, adhering to the pipe walls, soon grew to a point where they actually choked up the pipes. Before this action was understood a number of ocean-water intakes were installed leading down to the bay, but these, some even 14 in. in diameter, were soon entirely closed by the growth of animal and vegetable life so that they are useless, and cooling of the condenser water by atmospheric evaporation has had to be resorted to.

Abstracts of the N. E. L. A. Accounting Papers and Discussions.

SUPPLEMENTING the detailed report of the general, commercial and technical sessions contained in last week's issue, there is published herewith an account of the papers presented before the accounting sessions at last week's annual convention of the National Electric Light Association and the discussion thereon. A running report of the successful meetings of this section was published in connection with the general report of the convention in last week's issue, which also contained abstracts of papers of interest to accountants that were presented before other sessions. A number of those who attended the accounting sessions prepared discussions of the papers in advance, and these contributions to the program lengthened the proceedings and suggested more points for comparison of ideas, with the result that discussion was stimulated to a greater extent than at any of the previous meetings.

UNIFORM SYSTEM OF ACCOUNTING.

Mr. John L. Bailey, treasurer Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., presented as chairman the report of the committee on a uniform system of accounting. The committee devoted its time during the year to the work of interesting members in the standard classification of accounts. In this work 800 circulars and bound volumes of the classifications were used, resulting in ready responses from fifty-six companies. The efforts of the committee were directed to the end of placing the accounting system in an acceptable position so that wherever commissions are formed they will realize that the classification is standard and use it. This will tend to prevent the adoption of different systems in different States. The committee recommends that action be taken looking to the general adoption within a limited time of the standard system. In one or two States the companies cannot conform to the system, but it is desirable to make the accounts standard so that all of the commissions will be glad to accept them. The Maryland Public Service Commission has adopted the system for electrical companies under its jurisdiction.

In response to a circular letter of the committee, fifty-six companies stated that they would use the uniform system of accounts, fifty-three said they would not do so, and seven did not answer this question. Seventy-one companies approved the organization of a statistical department by the association, thirty-seven disapproved and eight did not answer this question. Twenty-six companies agreed if such a department should be organized to furnish regular reports thereto, while forty-six were unwilling to do so and forty-four did not answer this question. Thirteen companies were agreeable to the use of their names in the distribution of reports to member companies, while ninety-two raised objections to this suggestion and eleven did not answer the question. Thirty-seven preferred to have the name of the company omitted and only the State given, while eleven disapproved this alternative and sixty-eight did not answer the question. Fifty-five companies were willing to share the incidental expenses of the development of such data for reference, while forty-eight companies were unwilling to do so and thirteen did not answer this question. There were 684 companies that did not reply in any way to the suggestion for the organization of a statistical department.

The number of approvals is considered sufficient by the committee to warrant a recommendation for the establishment of a statistical bureau. The committee believes that the advantage derived from the interchange of figures would be sufficient to warrant the payment by the companies of the slight expense of maintenance of the bureau, but does not make any definite recommendation with regard to this feature of the proposed work. The committee therefore recommends the establishment of a statistical bureau without disclosure of the name of the company when information is given to an inquiring member, and that a sub-committee of the accounting committee be appointed to work out a suitable plan for the collection and dissemination of the information, as well as an equitable basis in the allotment of expenses if the executive committee should decide that the participating companies should bear such expenses. It is also recommended that a canvass be made during the convention in order to increase materially the number of companies submitting figures to a statistical bureau.

It is believed by the committee that it will not be possible to devise a set of standard forms suitable for all the varying conditions of member companies and acceptable to them. As such forms, however, would be a distinct benefit to a number of companies, it is recommended that the association authorize the committee to prepare and distribute a set of forms to each company.

DISCUSSION.

After presenting the report, Mr. Bailey emphasized again the importance of adoption of the classification by member companies.

Mr. H. M. Edwards, New York Edison Company, wondered whether the companies realized what an advantage they would secure from the exchange of statistical information. This information was of the greatest value to the large companies and he could not see why it should not be equally useful to the smaller properties. If names of companies are not to be given generally, arrangements can be made by which names could be interchanged by agreement. Sooner or later every state would have to meet the requirements of a public service commission. The accounting system had been designed after years of study and any commission should be glad to avail itself of this help in the introduction of a uniform system. If the system had previously been adopted by companies their argument for its acceptance by a commission would be helped materially.

Mr. Bailey thought that ultimately the executive committee would decide that the cost of a statistical bureau should be met by the association.

Mr. Frank J. Baker, North Shore Electric Company, Chicago, Ill., said that, while the National Electric Light Association classification had been approved by the Illinois Electric Association last year, scarcely any of the companies throughout the State had adopted the system. The reason with the smaller companies appeared to be the lack of forms. If the association could prepare forms for distribution 90 per cent of the smaller properties would adopt the system. Forms could be prepared and adapted for uniform application at moderate cost.

GENERAL OFFICE ACCOUNTING.

Mr. Franklyn Heydecke, of the Public Service Electric Company, Newark, N. J., said that the first thing to consider is the monthly statement of operations and the profit and loss statement. It is better to furnish the executive and operating officials with the general facts first and then follow with the details than to delay the statement for compilation of the details. Analyses of accounts can be made later when necessary. If an account shows the same amount as the same period of the previous year or a slight increase it does not require analysis. It is only when charges are unusually heavy or the reverse that analysis is required. Accounting on authorizations, both for improvements and repairs, is very interesting work. If enough of this work is done to justify the use of a separate ledger it should be provided. The books should be ruled especially for authorization accounting and should have the following columns on both the debit and credit sides: Date, name, material, amount and remarks. It is very important that sound judgment be used to distinguish between improvement and repair. The plant and property accounts should not be charged unfairly simply to make a good showing in improvements and in low operating expenses. When in doubt it is good policy to lean strongly toward charges to operating expenses.

If there are several underlying companies it is well to have the construction accounts separated so that the amounts expended for construction, extension and improvement on each

underlying property can be shown separately. At some future time the lease of the underlying company might terminate and the property return to the former management, when the controlling company would be entitled to compensation for betterments and improvements made.

DISCUSSION.

Mr. Hermann Spoehrer, United Electric Light & Power Company, of St. Louis, stated that the paper is of special interest to companies that operate several central-station systems. The system described by Mr. Heydecke is similar to that of the St. Louis company.

Mr. Frank Birch, Philadelphia Electric Company, said that a system that yields not only general data, but also details, is the most satisfactory one.

Mr. W. E. Freeman, New York Edison Company, said that scientific accounting is receiving the attention of the leading associations and governmental authorities, with the result of improved efficiency in administration and operation by all corporations. In general the staff auditor should keep or cause to be kept detailed books of account, as distinguished from the general books of account kept by the treasurer, showing specifically each operating revenue, operating expense and capital outlay by the company; and all books of operating or other accounts kept by the several departments or at the suboffices or stations should be under his direction and control. He should inspect and audit all such accounts, distribute the items of revenue, expense and outlay among the several accounts and prepare an abstract of such distribution and of the results of the company's business whenever required by the executive of the company.

The paper was also discussed by Dr. Fenner H. Peckham, Narragansett Electric Light Company, of Providence, R. I., and Mr. E. J. Allegaert, Public Service Electric Company, of Newark, N. J.

TRACING STOREROOM MATERIAL.

Mr. John T. Brady, treasurer of the Denver Gas & Electric Light Company, said that the development of the industry rendered it imperative to store an extensive supply of material. This made it necessary to devise plans for the proper care and handling of material, and a system of records to show correctly the receipts, disbursements and material on hand. Where stock is handled carelessly the fault is not so much in the system employed as in the failure to follow the regulations. One of the first rules upon which the success of the storeroom depends is that no material shall be given out without a requisition. The first violation of the rule usually leads to a repetition, which begets the habit and destroys efficiency. The storekeeper must be exacting. As the result of experience the Denver company has permitted few changes in the position of storekeeper, keeping the salary advanced as the service demanded and retaining men who have been in charge of this work for a period of years and who are so exacting that the general manager must accompany a request for material by his signature and a requisition.

Not enough importance is attached to the feature of storeroom facility. In crowded quarters confusion results invariably. Thousands of dollars may be spent or wasted if great care is not exercised in keeping supplies up to requirements. A system of records should be provided for the entry of all material received and disbursed. The use of a card record is usually advocated, but the loose-leaf ledger was preferred by the Denver company. Stock records are kept at the stockroom. A foreman's weekly balance sheet is used to show the name of the foreman, the number of the wagon, amount and description of articles drawn, balance on hand, materials used and the account to be charged. The material drawn is charged at the beginning of each week to the foreman, who is given credit at the end of the week for material used, as shown by the work orders, and is held responsible personally for material carried as balance on hand. The job-record figures submitted by the foreman are checked by the superintendent of construction and engineering department. The incandescent-lamp stock is received with the various other supplies at the warehouse. The electric-fan stock is also kept at the warehouse. An inventory is taken each month of a portion of the goods on hand. This affords an opportunity to take an inventory of each particular class of stock every six months. If losses occur or there is the slightest irregularity the difference can be adjusted and accounted for more rapidly and satisfactorily than under the old custom of making an inventory once a year.

DISCUSSION.

Mr. F. M. Tait, of Dayton, Ohio, said that it was very important to account properly for material returned to the storeroom.

Mr. E. S. Brock, Public Service Electric Company, Newark, N. J., said that after experience with a loose-leaf ledger he had concluded that no record was as satisfactory as that in a bound ledger. Loose leaves are liable to be lost after removal. It has been found impossible in Newark to introduce the weekly system of foreman's balance sheets, and materials are checked daily.

Mr. William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company of Baltimore, said that he believed it would be more satisfactory to have the storekeeper in charge of wagons.

Mr. F. L. Leitner, Edison Electric Illuminating Company of Brooklyn, said that district or operating departments are more efficient in sorting out returned material which can be used than the storeroom department. The substitution of one class of material for another is one great cause of discrepancies.

Mr. W. H. Bogart, New York Edison Company, said that that company has seven district storerooms which are supplied from the general storeroom. Material is given out on the order of the foreman and is checked twice before it is delivered. The wagon should be under the direction of the storeroom. Sometimes foremen use material charged to one job for another job. To overcome this difficulty checkers are employed. All moving supplies are checked twice a week. An inventory squad checks up the various storerooms. There is a similar squad which inventories the lamp stock.

Mr. E. J. Allegaert, Public Service Electric Company, of Newark, N. J., said that it had been found desirable to segregate appliances and supplies from regular materials. Separate records are kept for each.

Mr. K. C. Campbell, Peninsular Electric Light Company, of Detroit, thought that the responsibility of the storekeeper should cease when material left his control unless he had a competent representative on each wagon.

Mr. W. E. Freeman, New York Edison Company, said that all stores of the company should be under the charge of the storekeeper. Records in quantity should be kept in the general storeroom, but they should be supervised by the accounting department. He advocated the appointment of a store's inspector to report to the auditor and make inventories at stated periods.

Mr. H. M. Edwards, New York Edison Company, said that every corporation owes it to its men to surround them with every safeguard against temptation.

Mr. Brock said that on rainy days linemen sort scrap wire and place it on reels. The same practice is followed with other appliances, which are repaired when necessary.

Mr. J. H. Gulick, Commonwealth Edison Company, of Chicago, said that a record of quantities, not values, is kept on a card system by a man under the direction of the storekeeper. No periodical inspection is made and the storekeeper never knows when he may be checked up on any class of material. The storekeeper also charges out merchandise. Material used on different jobs is chcked at the place of work.

Mr. Leitner said that one of the greatest problems is that of obsolete material. Past experience is sometimes a false guide to the amount of stock and materials that should be kept on hand.

Mr. Bailey said that nowadays the storekeeper is not permitted to determine the materials to be bought.

Mr. Brady in closing the discussion said that the purchasing agent advises with the storekeeper regarding the price to be placed on material that is to be returned to stock. When the price of any material is low requisitions are referred to the superintendents. If they feel that it is an opportune time to purchase a larger amount than is really needed the requisition may be increased. The subject is often referred to the general manager.

Others who discussed the paper were Messrs. H. F. Fraase, Edison Electric Illuminating Company of Brooklyn, and C. F. Bryant, Westchester Lighting Company.

ELECTRIC VEHICLE ACCOUNTS.

Mr. Hermann Spoehrer, secretary and treasurer of the Union Electric Light & Power Company, of St. Louis, Mo., in a paper entitled "Electric-Vehicle Accounts as Applied to a Department of a Central-Station Plant" described the electric-vehicle business of his company and the system of accounting designed to analyze its various features. The company operates a garage in the residential section exclusively for electric-passenger cars and one for electric-power wagons exclusively near the commercial center. The company also sells electric-passenger cars and power wagons.

The classification of accounts for the electric-automobile department is divided into two general headings, entitled sales and garaging. The principal accounts under sales are passenger-car sales, power-wagon sales and fixed charges. Both passenger-car sales and power-wagon sales are subdivided into cost of machine, labor, material, advertising, office expenses and receipts. The account fixed charges is subdivided into two accounts, one for interest and depreciation and the other for taxes, insurance and rent. The general account garaging is divided into passenger-car garaging, power-wagon garaging and fixed charges. The two former accounts are subdivided into advertising, office expenses, general garaging, labor, material and electricity, repairs, labor, material and receipts. The separate accounts for labor and material in these sub-accounts are reported separately for charge on work-order sheets. Fixed charges are subdivided into interest and depreciation and taxes, insurance and rent.

The cost of a machine under the general heading passenger-car sales represents the cash cost f.o.b. at the company's garage, including freight. Labor represents the salesman's time, a portion of the time of the manager of the auto department and the cost of labor applied at the garage prior to the sale of the car. It also includes a flat monthly charge for the garage expenses of demonstrating cars. Material includes the expense of maintenance and repair of demonstrating cars and in connection with the salesroom. A depreciation charge is made against this account for cars used for demonstration purposes. Advertising includes charges for billboard and newspaper advertising, pamphlets, etc., and current supplied to auto signs of the company. Office expenses include the portion of light, heat, telephones and miscellaneous supplies properly chargeable to the sale of pleasure vehicles. Fixed charges include interest and depreciation on the garage-equipment investment, taxes, insurance and rent, which are apportioned between the sales and garaging accounts.

General garaging includes labor incident to ordinary garage service, a portion of the time of the auto-department manager, clerical help, etc. To cover repairs a standing work order is issued for each car. The items not chargeable to routine garage expense or which are of a special nature are charged to this account and entered upon the work-order sheet and billed to the customer with his regular monthly charge. The work-order sheets are written in triplicate. One copy is held by the billing department of the company, one copy goes to the purchasing department and the original is sent to the garage storekeeper and timekeeper, who enters all the material passing through his hands for use and the time spent on the various jobs. He then sends the sheet to the purchasing department for pricing. A general sheet is also used to carry the charges for all material used for general expenses of the garage not chargeable to any particular job, and for labor and material for jobs so small that an individual work-order sheet has not been issued. The expense of maintaining the vehicles of the company is kept separately and a daily charge made against the department using the vehicles. A standard work order is issued for each vehicle and is subdivided into labor and material. All expenses are charged directly to this order, and no operating or maintenance charges to the controlling account are accepted by the accounting department.

Careful and accurate data are indispensable in the settlement of disputes arising from alleged improper handling of customers' cars. A general sheet is kept to show the actual charging rate and voltage on every battery on charge in the garage during the twenty-four hours. Readings are taken every thirty minutes night and day. A second record is kept of the condition of each cell in every battery in the garage every ten days. A third record is in use for battery discharges, when made necessary by conditions. A fourth record shows the time each car in the garage leaves and returns, and other incidental information, including any special items, such as a broken lamp, fender, etc. Another record gives details regarding the tires. A regular printed form is used for instructions by the foreman for special repairs on any machine. No contracts are used in connection with the garage service, as it has been found to be poor practice to try to force the owner of a car to continue when he wants to leave.

DISCUSSION.

Mr. J. C. Scobell, Cleveland Electric Illuminating Company, said that the manufacturers of automobiles have made a successful campaign in Cleveland in the sale of pleasure vehicles and the business is largely of that nature.

Mr. W. H. Blood, Jr., president Electric Vehicle Association, was particularly interested in the classification of accounts, and believed that if this was followed it would give the information which is wanted.

Mr. Douglass Burnett, Consolidated Gas, Electric Light & Power Company, of Baltimore, said that that company felt that conditions warranted the development of electric commercial vehicle business and that it had established a garage for that purpose.

Mr. E. W. Goedjen, Commonwealth Edison Company, of Chicago, said that an effort should be made to induce manufacturers to establish a uniform plug.

Mr. Blood said that the standardization committee of the Electric Vehicle Association had been at work on various matters. One of the first matters taken up was that of standardization of the charging plug. The committee had been working with the pleasure-vehicle manufacturers and thought that within a short time uniformity would be attained. It is also working for uniformity of the charging plug for commercial vehicles, which appears to be a more difficult matter. The work of the committee is to go very much further.

Mr. J. W. Brennan, of Detroit, also discussed the paper.

In closing Mr. Spoehrer said that the garage is charged 1½ cents per kw-hour for energy. No distinction is made on account of different batteries on vehicles.

ELECTRIC-VEHICLE ACCOUNTING.

The report of the committee on electric vehicles, Mr. J. T. Hutchings, general manager of the Rochester Railway & Light Company, chairman, which was in part abstracted under the head of "Miscellaneous" in the *Electrical World* of June 1, contains a section that deals with accounting. The following classification of costs of operation is recommended: (1) General expenses—covering supervision, garage rent, wheel tax and State license. (2) Operating expenses—including the cost of oil and other supplies, general repairs, cost of electric energy, cost of repairs on tires and batteries, drivers' salaries, washing, oiling, minor repairs and garage expenses. (3) Fixed charges—interest, taxes, insurance and depreciation. The committee in an average-cost table gives the following items of operating expense as common to all who are operating under average con-

ditions: Oil and other supplies, general repairs, electric energy, tires and batteries. To find the total operating expense, however, there should be added the salaries of drivers, cost of washing and minor repairs and garage expenses. The latter items vary with local conditions. In the calculation of total costs fixed charges should be taken into account, and it is recommended that they be made on the following basis: Interest, taxes and insurance on the total cost of vehicles, and depreciation on the total cost of vehicles less the cost of batteries and tires.

ACCOUNTING FOR DEPRECIATION.

Mr. H. M. Edwards, auditor New York Edison Company, assumed in his paper on this subject that every company recognizes that its tangible assets are disappearing with use or with the march of improvement and realizes that some provision must be made in the accounts to provide for the replacement of worn-out or superseded apparatus. How should the amount to be reserved for depreciation be determined, and how should the reserve be treated in the accounts?

The Public Service Commissions of New York permit the capitalization of the new expenditure but require that the thing replaced shall be credited at its cost to property account and charged against the reserve, or, in the absence of a reserve, to surplus account. It is not proposed to argue the question whether this theory is correct and the fair one to apply in all instances, although there is much to be said against the absolute acceptance of the theory. Let it be agreed that the purpose of the fund is to maintain the efficiency of the property, as shown by the books, reinvesting the fund as the apparatus is replaced or retaining in the fund the cash equivalent.

Two methods of determining the amount to be reserved suggest themselves, the specific method and the general method. A company adopting the specific method would undoubtedly inventory its physical properties, noting in adjoining columns the original cost, scrap recovery value, life, etc. Assuming that the books have been properly kept, it would not be difficult to inventory the plant and list the costs. The life table would present a real difficulty, for, as the life of the apparatus determines largely the amount of the reserve, it must be reasonably accurate. The life of any piece of apparatus is affected by repairs and other conditions. The scrap recovery value also presents a difficulty. This value, it must be conceded, is largely conjecture, and at the same time may affect materially the amount of the reserve. One of the objections to the specific method is that it endeavors to treat with exactness what in the very nature of things is inexact and to the last degree approximate. The second objection is that the specific method takes no account of the factor of supersessionary depreciation.

Under the general method a reserve may be built up by a stated percentage of the inventory value of the property, by a percentage of the gross earnings, by a rate applied to the electric energy generated and sold, or by a definite amount appropriated from surplus earnings. A reserve created by any of these means is frankly approximate and its sufficiency can only be determined with the lapse of years. In this respect the method is in accord with the fact, for any reserve created to provide for the cost of replacement occasioned by use or supersession, and especially the latter, must be the result of approximation, and this approximation should not be in detail, but should be applied to the property as a whole.

The New York Edison Company started its depreciation reserve fund on the date of its incorporation, May 1, 1901. Generally speaking, depreciation is the result of kw-hours produced. A percentage of the book value did not include the element of work done and a percentage of the gross earnings did not bear equally on the product because of the rate schedules. The company finally adopted a rate of 1 cent per kw-hour sold to general customers. The selection of kw-hours sold rather than kw-hours generated was the result of local conditions and the fact that because of relations to affiliated companies a considerable portion of the energy generated did not circulate through its entire system, including transmission and distribution apparatus and devices. The company has been able to accumulate an adequate reserve which has provided for all its depreciation to date, with ample provision for the future.

Depreciation, whether from wear and tear or supersession, is a cost and must be recovered in the price of the product sold. The gross earnings, less the expenses of operations including depreciation, taxes and bad debts, would represent the net earnings from the business which bear a direct relation to the amount of capital invested. It is apparent, therefore, that the theoretical price for the product would be a sum derived from adding together operating expenses, depreciation, taxes, bad debts, cost of money invested and a profit on the money invested, and this sum total divided by the kw-hours sold gives the average rate per kw-hour which the company should charge.

It is customary to show the net earnings as applicable to the returns on the capital invested. It would not be consistent or logical to claim that depreciation is a part of the cost of the product and then provide for it through an appropriation from the surplus belonging to the owners of the property.

The Public Service Commissions of New York recognize that depreciation or amortization is an operating expense and their treatment of it is consistent and logical, for to permit a company to recover the cost of depreciation as a part of operating expenses necessarily implies that depreciation shall occupy an appropriate position in the schedule of operating expenses.

If reserves are accumulated separately for the production plant, the transmission plant, the distribution plant and the miscellaneous plant, a number of reserves will be established, and, although the sum total may be adequate for the company's purpose, yet individual reserves may be insufficient or excessive and transfers from one to the other would throw the entire system out of gear. The plan of the Public Service Commissions of New York simplifies all the transactions and treats the subject of depreciation in one item, the reserve accumulated being available for all the replacements which may be necessary.

If a company has accumulated a reserve for depreciation, it is not necessary to charge off at annual intervals a proportionate amount of the cost of the tangible assets; rather, the property should be carried in property account at its original cost until finally retired from service. This simplifies the accounting problem involved and enables an exhibit to be made of the status of the reserve fund, showing the unexpended balance remaining therein, and also identifies the cost of the actual apparatus retired and charged to the reserve.

There remains for consideration the status of a company which has not created a depreciation reserve fund, and upon this point it may be well to refer again to the rule of the Public Service Commissions of New York. The amortization rule in relation to fixed capital on Dec. 31, 1908, means that a company which has not heretofore established a reserve fund will only be allowed to charge against the fund after it is created that part of the depreciation of a thing which occurred after the fund was started, the balance being charged to surplus account. This is a very drastic rule, and it is not unreasonable to expect that a strict adherence to its provisions might require a company having no reserve to make charges to its surplus fund sufficient in amount to prevent the payment of dividends for years to come.

The following recommendations seem to be justified:

First—In view of the fact that depreciation in electric lighting plants is to an extraordinary extent the result of supersession rather than of wear and tear, the reserve should be determined by the general rather than the specific method.

Second—Considering the nature of the business, and because of the fact that the entire product consists of electric energy expressed in kw-hours, the most feasible way of determining the amount of the reserve is by a rate per kw-hour generated or sold, according as local conditions apply.

Third—In view of the fact that depreciation is a definite item in the cost of operation the reserve should be built up through operating expense and not as an appropriation from surplus.

Fourth and Finally—Any member company which has not as yet provided for a depreciation reserve fund should do so at once as otherwise the day of reckoning will soon arrive and delay may seriously affect its financial stability.

DISCUSSION.

Mr. N. J. Neall, of Boston, said that he had been examining returns of companies in the Second District, New York Public Service Commission, and found that only a comparatively small percentage of the total companies made any allowance for amortization. It would be highly desirable if some life tables should be furnished at a future convention to guide the members, even though the percentage basis should be adopted. The specific method appears almost necessary with some companies whose business is of such a character that it could not be considered as perpetual. Commissions like that in Wisconsin have given very serious consideration to the life of materials.

Mr. E. J. Allegaert, Public Service Electric Company, of Newark, said that replacements cannot properly be charged to plant account, unless the thing replaced is first written off at cost. The depreciation reserve is more or less incidental to proper accounting for depreciation. The very purpose of accounting in a business conducted for profit is to ascertain how much is actually made or lost. This information cannot be obtained unless all elements of the cost of conducting the business are taken into consideration. A plant, or a large part of it, is consumed eventually in the process of manufacture, and this extinction is an element of the true cost of conducting the business.

Mr. C. N. Duffy, Milwaukee Electric Railway & Light Company, agreed regarding the advantage of the general method as oposed to the specific method. The Milwaukee company has had this question before it. Since 1897 this company has set aside in a reserve for all depreciation charges 10 per cent of the gross earnings, and charges against the reserve every replacement, renewal and substitution. The life of any 100 cars varies with numberless conditions that cannot be covered in the accounts. To undertake to set aside funds on a sinking-fund basis on a life table would be absolutely impracticable. The companies in New York are to be congratulated that the commissions recommended the general method.

Mr. P. S. Young, Public Service Electric Company, of Newark, said that the general plan was the feasible one. It is a fallacy to say that it is not necessary to take care of depreciation if the property is kept up. It is impossible to spend enough in maintenance to take care of the waste.

Mr. W. H. Gardiner, Doherty Operating Company, suggested the propriety, as well as the expediency, of not only adhering to the general method, but of avoiding a definite method of application of a fixed rate from month to month, or year to year. Owing to conditions over which companies have no control earnings fluctuate, and while an average rate might be maintained, it could be varied from time to time.

Mr. E. A. Barrows, Narragansett Electric Light Company, Providence, R. I., said that Mr. Edwards emphasized the fact that the earnings remained after depreciation had been deducted. The Narragansett company has set aside a reserve for about the entire twenty-five years of its operation. The amount set aside was charged to plant account a number of times. It is now carried in a reserve fund. In the earlier years the depreciation reservation was the amount left after provision for dividends. That is not now the case. The directors vote the first of the year to set aside the estimated amount of the depreciation for the year. For the last seven or eight years the amount has been determined through the use of all the information available by the directors. It is very difficult to determine the proper amount, and any method which assists should be taken into consideration. The depreciation reservation is between 11 per cent and 12 per cent of the gross earnings, and slightly over 1 cent per kw-hour sold.

Mr. William B. Jackson, Chicago, Ill., believed that Mr. Edwards was fixing an iron-bound rule in one direction, while possibly some are fixing an iron-bound rule in another direction. The best man will take the best from both plans; neither one is a cure-all. When the facts are considered the matter of kw-hours output has nothing to do with the actual depreciation from wear or tear or obsolescence. The depreciation is the same whether the plant has a 20 per cent or a 40 per cent load-factor. There are two kinds of approximation: One is a guess and the other is an intelligent estimate, based on past experience and subject to revision, as necessity may indicate. The only way to revise this estimate is through the acquisition of additional information as to the life of property. The sufficiency of the amount set aside can be proved by an investigation of the plant step by step, and the addition of a little for some items and the reduction of a little in other items, yielding a final intelligent approximation.

Mr. Duffy said that analysis of balance sheets shows that adequate care of depreciation is not being taken.

Mr. J. H. Donlan, Edison Electric Illuminating Company of Brooklyn, N. Y., said that allowance for depreciation is made in court decisions. If the company bases its return on the capital expended its rates will conflict with those that would be determined upon a valuation which took into account the necessity for depreciation.

Mr. J. H. Gulick, Commonwealth Edison Company, of Chicago, said that the practice of that company is similar to that of the New York Edison Company. A monthly charge is made, and at the end of the year the various charges are placed against this sum and the balance is charged against the cost of plant.

Dr. Fenner H. Peckham, Narragansett Electric Light Company, said that it is important that there should be a practically unanimous agreement as to the amount that should be charged for depreciation. If those who are engaged in the business cannot agree upon the allowance that should be made it is illogical to expect others to do so.

Mr. Edwards said that when the New York Public Service Commissions' classification of accounts was under consideration one of the greatest questions which had to be determined was that of the treatment of depreciation. Those who represented the companies wanted to have the question left open because no data existed that would justify definite rates. A general method was finally selected. It was, as the paper stated, frankly approximate. If depreciation was designed to cover wear and tear only, the problem would be relatively simple. The problem is to provide for the supersessionary depreciation. Nothing is stationary. Every company has seen its investment swept away, not because it was worn out, but because new conditions made it absolutely necessary to scrap good machinery. Is anyone prepared to say that apparatus today is permanent? Any life table is inadequate, because it cannot take into account the development features of the business. The rate stated in the paper is the New York Edison Company's guess, the sufficiency of which can be determined only after a lapse of years. The balance sheet discloses a healthy state of affairs.

PURCHASING DEPARTMENT ACCOUNTING.

Mr. Thurlow W. Buxton, of the Edison Electric Illuminating Company of Brooklyn, described in his paper the purchasing department of that company and the important details in the methods of accounting for its three divisions—order, invoice and transportation. The storeroom and stationary departments are under the jurisdiction of the purchasing agent, and the lamp bureau reports to the storekeeper. The objects of distinctive accounting for the purchasing department are as follows: 1. To close the purchase properly. 2. To verify receipt of the purchase. 3. To verify the resulting expenditure with a minimum of dispute or delay. 4. To care for special

and miscellaneous matters. 5. To provide particular statistics and ready information. 6. To handle the sale of certain materials.

The order and the contract form the foundation of the system. Descriptions of material in the order should be exact, and prices should be noted, together with details as to the point of sale, terms of payment, shipping or routing instructions, etc. It is undesirable to permit any other department to purchase, obtain quotations or order material directly. When material is received the purchasing department secures reports from the departments involved, and, if the conditions have been met and the purchase is satisfactory, reports are issued at once. These reports are the principal authority for the passing of the invoice, which facilitates the passage of the bill for payment. In the case of contracts or large orders the terms of payment may call for instalments as specified portions of the work are performed and special estimates are prepared as the basis for payment.

All the invoices, manifests and bills of lading are received first by the transportation division. Certain special invoices deserve more attention than is given to ordinary transactions. The most important of these are the bills for coal and telephone service. A special record providing permanent statistics is kept of the coal. There are constant returns of material for various reasons, and it is necessary to have a permanent record of these as a basis for adjustment. Records of prices and quotations for comparison and constant reference must be maintained and be easy of access. A card system is used with a separate card for each item. All correspondence of every character is filed, when possible, with the contracts or orders concerned, which are given consecutive numbers.

Despite all efforts a number of bills remain unadjusted at the close of each month. A detailed list of these is prepared, giving the reasons for the delay. A statement termed "outstanding obligations" is prepared for the benefit of the fiscal department. It includes current obligations and an estimate of the amounts taken from the orders placed, which it is expected will be certified for payment on the tenth day of the following month. Freight and express bills, while handled mainly in the same manner as other invoices, are checked with established tariffs, rates and weights when possible, and in case of discrepancies are held until adjusted or claims are entered for overcharges. The purchasing department exercises direct supervision over the sales of all scrap material and discarded machinery or apparatus. Accommodation sales are made at prices fixed by the purchasing department, and sales of electric appliances are handled directly by the sales department. Cash is exacted for sales of scrap or discarded apparatus. When the exact tonnage of scrap is not known the buyer makes a cash deposit more than sufficient to cover the amount.

DISCUSSION.

Mr. John L. Bailey, Consolidated Gas, Electric Light & Power Company, of Baltimore, suggested that methods of avoidance of double payment of the bill be discussed.

Mr. John T. Brady, Denver Gas & Electric Light Company, said that double payment might happen if goods are not ordered in the regular way through the purchasing department. If goods are needed in a hurry a telephone message may be sent to the office and the purchase made immediately. This prevents irregularity.

Mr. W. E. Freeman, New York Edison Company, said that it is advisable to have the auditor retain the invoice and to have regular reports of goods received. If bills are referred to the heads of departments they may be lost.

Mr. E. A. Barrows, Narragansett Electric Lighting Company, Providence, R. I., uses a bill register on which all bills are entered. Any unusual delay is called to the attention of the proper official. This register is checked at the end of each month or at stated periods. It is important to see that advantage is taken of all bills on which discounts are allowed for prompt payment and that the machinery of the office does not delay accounts of this nature.

Mr. E. C. Scobell, Rochester Railway & Light Company, said that an invoice is sent with each order. Invoices are supplied to manufacturing companies with which much business is done.

Mr. J. C. Collins, Rochester Railway & Light Company, said that the uniform bill system had been in use for several years. It provides the information that the company wants and is a material aid to the general manager in passing bills.

Mr. Scobell, of Rochester, said that the policy of secrecy about prices had been abandoned by that company. It is now made the business of everybody to know the cost of materials. If these costs are known there are many cases in which less expensive material can be used on certain jobs.

Mr. Buxton in closing the discussion said that there is no reason why the rule to confine purchases to the purchasing department should not be followed to the letter. It is desirable to have shippers send a memorandum of shipment on the day the shipment is made.

Others who discussed the paper were Messrs. C. F. Bryant, Westchester Lighting Company; E. J. Allegaert, Public Service Electric Company, of Newark; F. L. Leitner, Edison Electric Illuminating Company, of Brooklyn; J. W. Brennan, of Detroit, Mich., and William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company, of Baltimore.

ADVANTAGE OF A JOB COST SYSTEM.

Mr. A. L. Holme, of the New York Edison Company, said that one of the reasons for the gradual development of the job-order system for all construction, and to a varying extent for repair work also, is that the executives of the company desire to be consulted before expenditures are made and to be assured that such expenditures, if authorized, will be made within the limitations approved. The system provides a requisition with sufficient description of proposed expenditures and an estimate of cost which, when approved, can be given an identifying number so that all costs may be assembled thereunder and after completion a comparison of actual and estimated cost be made. This feature alone is sufficient to warrant the use of the system. Cost data obtained gradually through the use of job orders will make estimates much simpler and more reliable in the future. Greater care will be exercised in the preparation of estimates because of the knowledge that comparisons will be made with actual costs after the work is completed. The advantages of such a system to the accounting department are also worthy of consideration. If expenditures are authorized simply with instructions to charge certain permanent accounts there is no assurance that instructions have been followed, and the auditor is without the means of determining whether the charges have been made correctly. The usual result of the policy of permitting officials or others to charge expenditures directly to accounts instead of job orders is that the construction accounts are made to carry more than their share.

Most companies favor the plan of charging all expenditures on job orders to a weekly account, transferring those chargeable to repairs monthly and to construction only upon completion of the work. When transferred to the permanent property account the completed job orders form a full inventory of construction. It is difficult to make any positive statement as to the extent to which job orders should be used to cover each piece of work. This is influenced by the organization of the company and the functions of its various departments, as well as the extent to which expenditures are charged to capital accounts. It is a fairly general practice to insist on approved job orders to cover all expenditures on capital accounts, but even the definition of capital expenditures will not be uniform. The objections to the introduction of a comprehensive job-order system are based on its cost. This objection is warranted where the system is kept solely as an auxiliary to the regular accounting system. Where introduced as a part of the accounting system and all unnecessary duplications are avoided it will be found, so far as the job-order system applies to the record of cost, that there is practically no added expense, for

items of expenditure must necessarily be assembled in some way. The real expense will be confined, therefore, to the extent to which additional details of cost or descriptions are carried on the cost sheets in order to supply information readily. That expense can be avoided by suitable arrangements for filing data. In the New York Edison company practice all station construction or reconstruction work is performed by or under the supervision of the construction department. The work in the streets, whether construction or repair, is performed by the distribution department. Both of these departments do their work entirely on job orders. To take care of the regular maintenance work of the distribution department standing job orders are issued to cover the various classes of operating expenses as well as so-called emergency repairs within certain limitations of cost. An annual budget of estimated construction is prepared early in the year, and the bulk of the work of the construction department is done thereunder.

When labor details are checked with the estimate investigations are caused occasionally which develop that the work cannot be done in accordance with the estimate. A supplementary estimate is then prepared and submitted to the construction committee for approval.

DISCUSSION.

Mr. J. W. Brennan, of Detroit, said that the system tends to confine the cost of work to the estimate, and also avoids occasional clerical errors. The same system is followed in all shop work, including switchboard construction.

Mr. Paul R. Jones, Doherty Operating Company, said that no work of investment or operation is conducted as a rule without a job order. This keeps an accurate cost of all work and of the men. In some cases the superintendents or foremen will employ more men than are necessary if there is no check of this nature. A proper record cannot be made without the job order system.

Mr. T. W. Flowers, Edison Electric Illuminating Company of Brooklyn, said that a series of numbers is kept for service orders and another series for construction work. The company is trying to create an index for construction orders. In reconstruction work the original cost of the line is ascertained or an estimate is prepared by the engineers. The net depreciation is charged to the amortization account.

Mr. H. M. Edwards, New York Edison Company, said that the advantages of this system had been described before the association for many years. Ordinary operating transactions can be gaged on the basis of kw-hour costs, but there is no way of checking construction and repair jobs unless work orders are used. The system is used by companies in New York, Chicago, Brooklyn, Philadelphia, Boston and other cities. It is of particular advantage in connection with the accounting system of the Public Service Commission, which in capital expenditures wants to know how the money is used and sends an inspector to identify the physical elements. By the use of this system work that was almost thirty years old was identified. Nothing helps a company so much with a regulating commission as to be able to show by its books what has been done. He would not recommend any system that is not used as part of the accounting system. This enables the construction committee, which meets about an hour once a week, to keep in touch with all projected work. As the system is part of the accounting system no cost is involved that would not exist otherwise.

Mr. Hermann Spoehrer, Union Electric Light & Power Company, of St. Louis, said that the work order system is of inestimable value in inventories.

Mr. J. C. Collins, Rochester Railway & Light Company, said that the job order system has been in successful use by that company for several years.

The paper was also discussed by Messrs. John L. Bailey, Consolidated Gas, Electric Light & Power Company of Baltimore; E. J. Bowers, Kansas City Electric Light Company; W. E. Freeman, New York Edison Company; F. L. Leitner, Edison Electric Illuminating Company of Brooklyn, and William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company, of Baltimore.

HANDLING OF CUSTOMERS' ORDERS.

The paper on this subject by Mr. R. F. Bonsall, of the Consolidated Gas, Electric Light & Power Company, of Baltimore, was read in his absence by Mr. Douglass Burnett. Each order form should be part of a system. The entire system should be planned in detail from the time the unsigned forms are placed in the hands of the salesman until service is connected and the account is opened on the ledgers. All order forms should meet the requirements of the various departments concerned before they are adopted. The general public gains its first impression of a central-station company when it is asked to sign an order for service. The necessary forms of agreement can be made either a source of annoyance to the customer because of the number presented for signature or, because of their brevity, the means of a satisfactory introduction. Orders should be so drawn as to embody all the work of a certain class under one agreement.

All forms should be of a standard size convenient for filing and printed on papers of different colors to signify different classes of work. The most efficient form will permit the necessary number of carbon copies to be made at one time. The application for new service should contain the printed schedule of rates for the particular service desired as well as the general terms and conditions under which service is supplied. In taking an application for lighting service salesmen should try to secure also an order for the necessary equipment of lamps. The experience of the Baltimore company shows that meters should be allowed to remain on the premises for three months after service has been discontinued.

Unless a valid reason is advanced by the operating department, all orders not executed within the usual time limit should be brought to the attention of the head of the department. In cities where a municipal or underwriters' certificate of approval of wiring is required it will aid in the prompt handling of orders if a complete record of certificates is kept on the cards.

DISCUSSION.

After reading the paper, Mr. Burnett emphasized the advantages of a form that should cover at one writing the many details concerned.

Mr. John F. Gilchrist, Commonwealth Edison Company, Chicago, Ill., said that the paper covered operations of the greatest importance in the proper handling and management of the business.

Mr. E. M. Podeyn, Edison Electric Illuminating Company of Brooklyn, said that it has been found necessary in the work of that company to organize a customers' bureau upon geographical lines.

Mr. W. A. Cox, Public Service Electric Company, Newark, N. J., said that a card record is kept of all unfinished work. It is not good practice to furnish service without the signature of a new customer unless he is well known. It is essential to warn customers against going to any expense for wiring until rights-of-way for lines are secured.

Mr. R. S. Hale, Edison Electric Illuminating Company of Boston, Mass., said that in a case of doubt as to the necessity for securing right-of-way the agent takes an application from a customer with a warning that it may not be possible to secure the necessary permits. A special form is used similar to a timetable, calling attention to the time ordinarily required to install different classes of service. This shows the probable limits within which the service will be completed, and the customer is requested to notify the company if the desired work is not completed within the time specified. If after investigation it is found in ordinary cases that rights-of-way have to be secured, immediate notice is sent to the customer.

Mr. W. H. Rogers, Public Service Company, of Paterson,

N. J., said customers are divided into two classes—the responsible and those who are not responsible. Some are required to give forty-eight hours' advance notice of removal and others are required to make a deposit.

The report was also discussed by Mr. L. A. Coleman, United Electric Light & Power Company, of New York, and Mr. H. E. Neisz, Cosmopolitan Electric Company, of Chicago.

Mr. Burnett in closing the discussion said that all concerns that do electric wiring in Baltimore operate under State licenses. Daily lists of certificates issued are secured, together with applications from contractors. It has been found that discussion of the details with the customers facilitates the work of the office. To prevent outstanding orders from accumulating in an unnecessary degree solicitors are requested to withhold applications until a definite time limit for completion can be fixed. Inspection is effective in many cases in revealing the existence of defective work which might not be discovered promptly otherwise.

COLLECTION OF BILLS.

In a paper entitled "The Collection of Bills" Mr. Edward J. Bowers said that the Kansas City Electric Light Company did not employ banks, express companies or drug stores as collection agencies for the reason that a large percentage of the remittances received are in checks. When a company becomes of such size that it has to maintain a collection bureau separate from its billing and bookkeeping department the question is raised as to how the collections shall be made. Such companies are in a position to offer a reasonable discount for the prompt payment of bills due them, and are justified in enforcing rules. The discount must necessarily be much larger than that offered by mercantile institutions. It should be simple and easy to figure and sufficiently attractive to customers to induce them to pay during the discount period. It must also be taken into consideration in rate-making. The object of such a discount is to decrease collection expenses and reserves for bad debts, and to a certain extent increase the revenue of the company through discounts forfeited. Court decisions have upheld the reasonableness and justice of rules concerning discounts allowed, penalties exacted and deposits required in advance.

All contracts for credit are based upon the approval of references, the reports of Bradstreet's and Dun and the amount of property in the possession of the applicant. Applications for service in cases where bills were unpaid at the former homes are not passed until the old account is met. A cash deposit sufficient to cover three months' service or a guarantee of real-estate owners is required in the case of pool halls, picture shows, saloons, restaurants, barber shops, etc., where there is risk of loss in collection. A card is kept for each delinquent account. These cards are arranged by districts corresponding with the customers' ledgers and handed to the collection department. A first notice is written to the consumer requesting a remittance by a certain date of a delinquent account. The card is then advanced to this date, approximately five days, in the follow-up system. If a reply is not received a second notice is sent stating that service will be discontinued unless settlement is made by a certain date. The card is then advanced to the second date. If the account is still not paid at the expiration of that time a cut-off list is made out and sent to the trouble department. This department sends a man, together with a representative of the collection department, to the premises of the customer and service is discontinued unless the collector is paid at that time. After a reasonable length of time the meter is removed and the account placed in the hands of an attorney for collection. Ninety per cent of the delinquent customers paid their accounts as soon as they were told that service would be discontinued. The practice of sending delinquent notices through the mails is apparently the quickest and least expensive. Payments received after the discount date for less than the full amount are returned to customers with a letter. In these cases the envelopes in which the remittances are received are held by the cash department.

DISCUSSION.

Mr. Daniel Goss, Edison Electric Illuminating Company of Boston, said that all bills are rendered net by that company. At one time the introduction of a discount system was considered and questions were sent to thirty companies asking for information regarding their experience. No reply showed as large a percentage of payments as the Boston company was receiving by rendering net bills. It was then decided to make no change and consideration was given to a follow-up system designed to assure the prompt payment of accounts, and also a check on collectors. A plan of changing collectors was tried, but discontinued. Collectors are given a certain ledger, or a portion thereof, and the entire responsibility for the collection of the accounts is placed under their jurisdiction. With the old system the company averaged from 1800 to 2000 accounts per collector, but now has an average of 3300 to 3500. One man located in the country has 4500 accounts and covers his district in an automobile. The system expedites the prompt payment of bills and eliminates complaints, because it applies equally to all customers, large or small.

Mr. George E. Burns, Commonwealth Edison Company of Chicago, said that that company has a system of allowance of a discount for payment in ten days. This is advantageous in attracting the prompt payment of bills.

Mr. John F. Gilchrist, Commonwealth Edison Company of Chicago, said that all retail customers receive a discount of 1 cent per kw-hour.

Mr. J. C. Van Duyn, New York Edison Company, said that weekly accounts are required from some classes of customers. Payments are made at various branch offices of the company. Frequently the business status of a customer may change. It is important to show the customers doing certain classes of business that they can have about the same amount of credit that they would receive from merchants with whom they do business.

Mr. E. J. Allegaert, Publie Service Electric Company, of Newark, N. J., said that a comparison of two offices showed that the collection expense was much less in the flat-rate office than in the discount office. The percentage of bad debts was also less. The allowance of a discount as great as 10 per cent, or 1 cent per kw-hour, cannot be justified. If a discount is wanted 2 per cent or 3 per cent is ample. A reasonable business chance should be assumed in the extension of credit.

Mr. Hermann Spoehrer, Union Electric Light & Power Company, of St. Louis, said he had found it effective to bond the trouble man and let him collect the bill.

Mr. H. M. Edwards, New York Edison Company, said that where public-service commissions have jurisdiction bad debts have been decided to be operating expenses.

Mr. W. H. Rogers, Public Service Electric Company, Paterson, N. J., said that a weekly bill enables certain classes of customers and small business men to know each week where they stand.

Mr. Louis H. Egan, Kansas City Electric Light Company, said that that company has no competition in electric lighting and practically none with the gas company on account of the low price of gas.

Mr. Frank W. Smith, United Electric Light & Power Company, of New York, said that six months ago the company began to present its bills to customers and the expense is about the same as with the old method. The experience was very satisfactory because it led to personal touch with customers.

The paper was also discussed by Messrs. W. H. T. Jones, of New York; L. A. Coleman, United Electric Light & Power Company, of New York; Leon H. Scherck, of Newburgh, N. Y.; J. H. Gulick, Commonwealth Edison Company of Chicago, and W. E. Freeman, New York Edison Company.

THE USE OF TABULATING MACHINES.

Mr. William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company, of Baltimore, in his paper on "The Extent to Which the Tabulating Machine Can Be Used in Accounting

Work" said that it has been possible to secure information at a very small expense through the adoption of various mechanical office and accounting devices. These devices have not only permitted the calculation of more statistical information but they have also helped in the compilation of reports more promptly and with greater accuracy and less expense than before.

The machine that has been of the greatest help to the electrical companies is the tabulating machine which made its first appearance in the Census Bureau at Washington. This has been used as a general rule only for statistical information, but it is equally useful in general and commercial office work. The outfit for this system consists of cards, the key punch, the gang punch, sorter and tabulator. Mr. Schmidt said that in his company the machine is used for tabulation of the monthly electric sales. A monthly bill can be checked very quickly and at less expense by the use of this machine than by other methods. The tabulating system is also used for a daily analysis of the incandescent lamps, tungsten lamps, shades, etc., issued from lamp renewal rooms. This analysis show the class of issue, such as free renewals, charge renewals, cash renewals, etc. If this analysis had to be made on tabulated sheets, the expense would be almost prohibitive. Information has also been compiled as to the meters, indicators, transformers and arc lamps in service and as to the number of poles and apparatus attached. Arrangements are now being made to take care of the voucher distribution by use of the machine instead of with the present sheets. It is also planned to use the machine in connection with the payrolls, stores, accounting and a job-order system.

The adding and listing machine can be used for many classes of work. Where the coupon system has been adopted in billing this machine can be used in listing coupons received each day. It is also used in the compilation of the total daily credits for each individual ledger and for taking off the unpaid accounts at the end of each month, as well as by the collectors and in the storeroom. It has been found that it pays to keep at least one adding machine in each department where there is any adding or listing to be done. The machines are electrically driven and are believed to be one-third more efficient than the hand-driven machines.

The calculating machine is invaluable in the calculation of costs and cost statements. Two billing typewriters are used. Another machine which plays an important part is the addressing machine. This can be used in the opening of new ledgers. The machine can also be used on the payrolls and employees' service cards. An electrically driven printing outfit is used for form letters. In conjunction with the printing machine, various duplicating devices are used for copies of statements and other papers. Rubber stamps are used in the gas division to show the gross amount, discount and net amount. A change-making machine enables the receiving teller to attend more promptly to customers. A somewhat similar machine can be used in connection with the payroll. A receipting machine can be had by the receiving teller. An electric envelope sealer helps to reduce the office-boy expense. Numbering machines may also be mentioned among the devices used in modern offices.

Mr. Schmidt said he would like to see the association maintain a bureau to collect information concerning mechanical devices designed to effect economy and accuracy and to increase facility.

Central Station
Management, Policies and Commercial Methods

ELECTRIC INCUBATOR LOAD AT NEW ORLEANS.

Many people in New Orleans have taken up with enthusiasm the raising of chickens at home, and as a result of this interest the New Orleans Railway & Light Company has acquired a number of electric-incubator customers. About forty such incubators are now in use, ranging from the small seventy-egg domestic size to a large machine in use by a commission merchant which is arranged for 3000 eggs. The electric incubator load is a steady, long-hour demand during the three-week period of hatching, after which electric brooders extend the use of central-station service for another month. The incubators used in New Orleans, which, according to Mr. W. E. Clement, contract agent for the electric company, are giving entire satisfaction to their users, are the product of a local maker, the Electric Manufacturing Company. The feature of their construction is the bridging of the thermostat contact points by a small lamp, which prevents arcing destructive to the points and also serves as a visible indication of the thermostat's operation enabling the adjustment screw to be set quickly for the desired hatching temperature, which averages 103 deg. Fahr. The seventy-egg incubator has a 45-watt heater, but takes only 7 watts when the thermostat is open, and the consumption averages 20 watts with ordinary outside temperatures. The 120-egg machine takes a maximum of 55 watts, minimum 8 watts, and average 23 watts; 200-egg, maximum 70 watts, minimum 9 watts, average 35 watts; 300-egg, maximum 140 watts, minimum 18 watts, average 50 watts. In New Orleans these domestic installations are operated on the regular rate of 10 cents per kw-hour. The electric brooders take continuously about 20 watts per seventy-five chicks. The large 3000-egg commercial incubator, mentioned above, is made up of twenty 150-egg compartments, each with its separate thermostatically controlled heater, these averaging 30 watts, so that any part or all of the incubator can be used as desired. According to Mr. Clement, these electric incubators at New Orleans have reached the point where they constitute a characteristic central-station load, and one which, on account of its long-hour demand, is desirable business on residence lines where the machines are principally in use.

CENTRAL-STATION VERSUS MUNICIPAL-SERVICE AT GALVESTON, TEX.

The city of Galveston, Tex., for which Mr. W. D. Masterson is electrical superintendent, has entered into a contract with the Brush Electric Light & Power Company, which has a 4300-kw turbine-driven central station, to supply the energy for its 350 magnetite street arc lamps, shutting down for the present at least the city's new 200-kw steam-turbine plant. The immediate cause of this change is the 10-cent excess premium imposed on all insured property in the city of Galveston as the result of the city lighting plant's being housed in the same engine-room as the high-pressure waterworks pumps. The rectifier-transformers will accordingly be transferred to another part of the building and central-station energy to operate them will be purchased at 2.5 cents per kw-hour, practically the same figure as has been the cost of operating the municipal turbine plant using oil as fuel. The good load-factor of the city lighting load, however, has made it possible for the central station to supply this service satisfactorily at this low figure. Electric pumping for the city of Galveston is also contemplated. The water supply for the island comes from a group of artesian wells at Alta Loma, 20 miles inland on the mainland, from which point the supply is piped to Galveston. The plans for electrifying the water supply contemplate installing three 75-hp motor-driven pumps at both the Alta Loma wells station and the Galveston pumping plant, all receiving energy from the Galveston central station.

CENTRAL-STATION SERVICE TO TELEPHONE COMPANY'S MANHOLES.

Through a spare duct of its conduits in the underground section of Muskogee, Okla., the Pioneer Telephone & Telegraph Company, which is the local Bell concern, has carried a pair of No. 12 110-volt duplex conductors in Greenfield armored conduit for operating electric soldering irons, fans and lamps in the forty-seven manholes of its sub-surface system. The electric-service pair was installed by the telephone company's employees in one of the spare lower ducts of the tile conduit at the time of pulling in the other cables, and in each manhole it is led to an outlet box inclosing an Edison-base socket into which any desired cord extension can be plugged. Use is made of the electric service thus available for operating electric soldering irons and also for lamps where the hole is dark or work has to be done after night. An especially useful purpose of the wires, however, is the operation of electric fans. During the warm summer weather in Muskogee these fans are genuinely appreciated by telephone employees who have tedious jobs of cable splicing and wiping to do in the hot manholes. The supply of energy for the underground-manhole system is from the lines of the Muskogee central-station company, the wires entering the conduit through a separate meter in the telephone company's basement. Last summer, when a good deal of new construction work was being done in the underground manholes, an average monthly consumption of 100 kw-hours was registered by this meter.

A STEAM-LAUNDRY CENTRAL-STATION AUXILIARY.

Frequently when the central-station solicitor approaches the local steam-laundry manager on the subject of motor drive and electric heating for his washing and ironing machinery the argument is advanced that, since exhaust steam and hot water are needed anyway, the boiler and engine plant may as well be operated to furnish power for the machines. When this attitude is taken the laundry is a difficult customer to get.

If, however, the central station is operating non-condensing and perhaps serving an exhaust-steam heating load in winter, it can sometimes be pointed out to the laundry manager that he can profitably shut down his steam plant and move his whole laundry equipment to new quarters near the electric plant, purchasing from it exhaust steam for water heating, electricity for irons, and perhaps a small amount of live steam for the mangles. The laundry is thus spared the nuisance and expense of keeping up isolated boiler equipment, while the central station gets a good year-round customer for part of its exhaust steam, besides landing an excellent daylight electric motor and heating load otherwise unobtainable.

In a Minnesota city of 4500 inhabitants where the central station has 175 kw in generating equipment driven by Corliss engines, and does a steam-heating business during the winter, summer use for its exhaust steam is provided by heating water for a steam laundry, three hotels, three barber shops and two apartment buildings. As the plant is operated with a back pressure of from 2 lb. to 3.5 lb. per square inch, winter and summer, this water-heating business is found of great service in helping to carry the plant over the light-load summer period.

Of course, the steam laundry is the best user of exhaust steam during the summer period. The laundry is located adjacent to the electric plant and is supplied with exhaust steam for water heating through a 3-in. lagged pipe line, and with live steam for its large mangle through a 1-in. high-pressure steam line. The large mangle, two washing machines and a centrifugal drier are all driven by electric motors, and electric heat is used for the flatirons and collar machine. The electricity consumed for heating purposes and for motors has averaged about 615 kw-hours per month. Steam is sold by meter at an average rate of 70 cents per 1000 lb. of condensation. The income for the steam used by the drier, mangle, water heater and several small machines has averaged $22.75 per month. The exhaust steam utilized by the steam laundry is about one-fourth the quantity passed through the steam engines of the electric plant during the summer period of operation.

The heating of water for barber shops, flat buildings and hotels near the plant has also been found to be a profitable adjunct of the regular summer service in the case of this central station.

DISCUSSION ON ELECTRICAL VEHICLES IN IOWA.

Mr. F. H. Golding, general manager of the Rockford Electric Company, appeared before the Iowa Electrical Association convention at Davenport on April 1 with a paper on electric vehicles which gave principally the experience at Rockford. He said that ten years ago the construction of electric vehicles was such that they were confined to cities with level and well-paved streets. Now on account of the improvement in batteries, tires and vehicles there are but few cities where the electric vehicle is impracticable. Rockford has 165 electric vehicles. There are seventy-seven private charging stations. The rate is 6 cents per kw-hour for private users and 4 cents to public garages, which retail it at 6 cents. This is on an "off-peak" contract whereby the vehicle users agree to keep off the lines at the time of the central-station peak. The average revenue is $60 per car per year. He gave the usual cost of electric-vehicle operation per year as $180.

For a number of years the company employed a battery man who maintained vehicle batteries for consumers. More recently garages have taken up this work. One garage handles electric vehicles exclusively, and another about half electric and half gasoline. Mr. Golding thinks the electric vehicle with its present possibilities will become a formidable competitor of the gasoline car.

DISCUSSION.

Mr. Thomas Crawford, of Clinton, compared Rockford development with that at Clinton, which has only forty-five vehicles and is about one-half the size of Rockford.

Mr. Golding, in answer to a question as to how the electric compares to the gasoline vehicle in hill climbing, said that he had a runabout which climbs 6 per cent and 7 per cent grades in bad weather without trouble and, in fact, the electric vehicle is about the only one which does not have trouble in bad weather on grades. He also told of a case last fall when a football game was held 2 miles north of the city with a long stretch of soft road between. He went out and returned with his electric car, passing several gasoline cars stuck on the way. The mileage obtainable on one charge under favorable conditions is about 100 for a lead battery and 160 for the nickel battery. The majority of gasoline garages in Rockford do not handle electric vehicles at all. His company still does some work on minor troubles and inspection.

Mr. H. C. Blackwell, of Davenport, told of a 2000-lb. truck which his company has been operating for fourteen months for the delivery of material and men in its gas and electric departments. Repairs so far had been $14 a year, or a trifle over $1 per month. The batttery is divided into four sections. A fifth reserve section was also purchased so that one section could be taken out for repairs. This truck takes 6 kw-hours per mile. He could not estimate the saving over old methods because the most important saving of all was in the time of men who are ready to be moved from one job to another, and this cannot be measured accurately. Two more electric trucks have been ordered, one for delivering freight from depots in Rock Island and Davenport, and the other for miscellaneous purposes, delivering meters, etc.

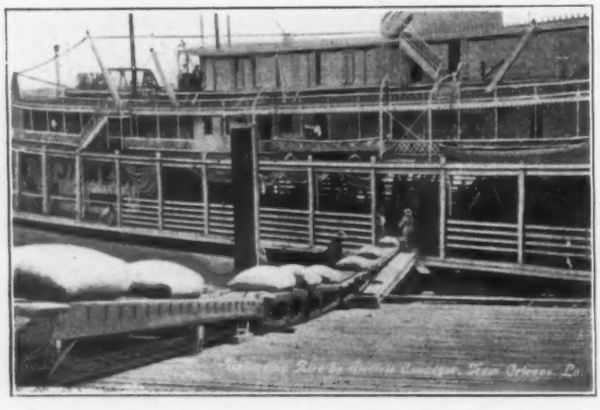
Mr. P. B. Sawyer, of Des Moines, said that he had determined that a certain gang of men now does 2.5 times the work with one electric truck at its service that it did before, when it had to wait for transfer teams. The cost was 18.6 cents per truck-

mile, including 12.5 per cent depreciation. Mr. Golding said that the electric passenger vehicle is suited for business and professional men for driving around town where frequent stops make the cranking of a gasoline car objectionable. The electric is also suitable for ladies. Closed electric vehicles now outnumber the open runabouts five to one. Mr. Gus Lundgren, of Cherokee, asked about the possibility of competing with light gasoline grocery wagons. As near as he could find out such a wagon in his town was out of service about half the time. Mr. Golding thought the electric delivery wagon would be able to compete with this from reports he had from gasoline delivery wagons in use by central-station companies at Auburn, N. Y., Canton, Ohio, and Scranton, Pa. The manager at Canton stated that they could keep the wagon going by overhauling it once a week, while at Auburn and Scranton the comments of the managers on the performance of the wagon were anything but complimentary.

Mr. H. C. Blackwell, of Davenport, expressed the opinion that if electric trucks were to be introduced in his neighborhood the central-station company must start a maintenance bureau to look after the trucks of customers.

UNIT MOTOR-DRIVEN CONVEYORS FOR UNLOADING MISSISSIPPI RIVER STEAMBOATS.

Bags of rice, coffee, cotton seed, meal cakes and bales of cotton are unloaded from steamboats plying the lower Mississippi River and adjacent waters by means of unit motor-driven belt conveyors which carry the packages from the vessel's deck and up the levee slope to the warehouse floor, as seen in the accompanying illustration. This shows a group of five such 25-ft. unit sections conveying 190-lb. bags of rice from the boat



Unloading Rice by Electric Conveyor at New Orleans, La.

deck up a 20-deg. grade at a speed of 200 ft. per minute. The portable units of which the conveyor is made up consist of self-contained 25-ft. lengths of 20-in. conveyor belts running on pulleys and idler rollers, each unit being driven by its own motor of 2-hp to 5-hp rating. The ends of the conveyor sections are provided with connection plugs and sockets, so that any number of units can be operated, clamped together in line, as desired. The bags are delivered to the warehouse faster than a single set of men can handle them, so by means of a trip they are dumped into three separate piles from the end of the conveyor. Stacking machines are also in use employing a sort of inclined conveyor which lifts the bags to the level of the piles being worked. These unique conveying devices were designed by Mr. Edward Hanak, of New Orleans, and are protected by a number of patents which he holds. All of the units are easily portable, and can be hauled aboard the boat for use at any loading point. The conveyor motors are arranged for 110 volts, the standard pressure of the steamboat lighting plants from which the conveyors are operated at landings where central-station service is not available. The conveyors handle packages weighing up to 400 lb., and any object larger than 12 in. x 12 in. will bridge the gap between adjacent belts with safety. The conveyor system illustrated delivers 1200 bags per hour from boat to warehouse.

CONTRACTORS' USE OF CENTRAL-STATION ENERGY ON GALVESTON CAUSEWAY AND REGRADES.

The city of Galveston, Tex., occupies a low, sandy island in the Gulf of Mexico, 2 miles from the mainland. Following the calamity of 1900 a 17-ft. concrete seawall was built protecting

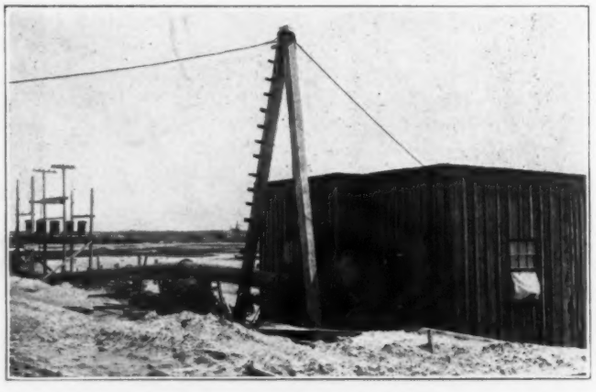


Fig. 1—Motor-Driven Booster Pump for Filling Galveston Causeway.

4½ miles of the ocean front, and behind this wall the grade of the city was raised 17 ft. by steam dredges pumping sand onto the low surfaces.

Since the completion of this original work of protecting the city from the waves, two other large and important undertakings have been in progress during the last year, involving the transfer of more than 2,500,000 cu. yd. of material, all of which was accomplished by motor-driven sand pumps using central-station energy. The first of these works, just completed, involved the construction of a sand crowning, 500 ft. wide and 5 ft. thick at its crest, along the entire length of the sea-wall filling, providing the base for a splendid ocean boulevard. Altogether 1,198,331 cu. yd. of sand was applied in this fashion, using in general the same methods employed in the undertaking now in progress, the building of the Galveston causeway from the island to the mainland.

This causeway is 10,642 ft. long, being made up of about 2000 ft. of unprotected roadway approach across the flat wastes of the island; 6200 ft. of concrete-protected roadway, and a bridge section 2400 ft. in length for accommodating tidal flow. This bridge section, near the middle of the work, comprises twenty-

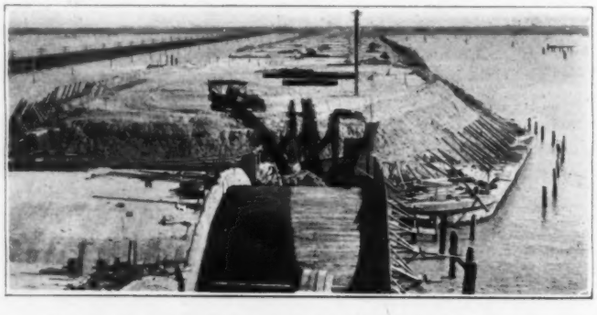


Fig. 2—Completed Fill on Galveston End of Causeway.

eight concrete spans and a 100-ft. steel rolling-lift bridge for passing commerce through the bay. The causeway level is 16 ft. above mean tide, and the roadway section is 119 ft. wide and the bridge section 66 ft. wide. It is designed to carry two rail-

road tracks, two electric-railway tracks and a country road. The completed causeway will cost $1,500,000.

The protected portion of the causeway is being constructed by placing in position two rows of concrete sheet piling tied together by steel members. Then into the space between these concrete walls sand is discharged from dredge lines. The unprotected approach roadway on Galveston Island is also being formed by means of sand applied from the dredge. The unprotected roadway will require about 600,000 cu. yd. of sand, and the two protected sections of the causeway proper will take nearly the same amount.

The steam dredge with its suction line is located in a bayou on the island near the causeway. This dredge is capable of conveying about 150,000 cu. yd. per month through its 20-in. discharge line, but cannot satisfactorily deliver at distances above 3000 ft. For conveying the sand and water out onto the causeway when one pipe line reaches a length of 12,000 ft. booster pumps are required at 3000-ft. intervals. These pumps, similar to that on the dredge, are chain-driven by 250-hp, 2300-volt, 60-cycle, two-phase motors supplied through transformers from the 11,000-volt transmission line from the generating plant of the Brush Electric Light & Power Company, of Galveston, 5 miles distant. As the work progresses from the island shore additional booster pumping units are addded every 3000 ft. When one pump was in use 5500-volt transmission was employed and this was raised to 8800 volts and then to 11,000 volts as the second and third pumps were put into service, the transformer ratio being suitably changed to give 2300 volts at the secondaries. The present pipe line, used for filling the mainland end, is carried from the dredge in the bayou, through two booster pumping stations on the south end of the causeway, through an inverted siphon at the drawbridge channel and up again to a third pump on the mainland end, where the discharge is now located. The sand is being pumped onto the filling for a height of about 15 ft. above the edge of the piling, after which it will be faced with concrete.

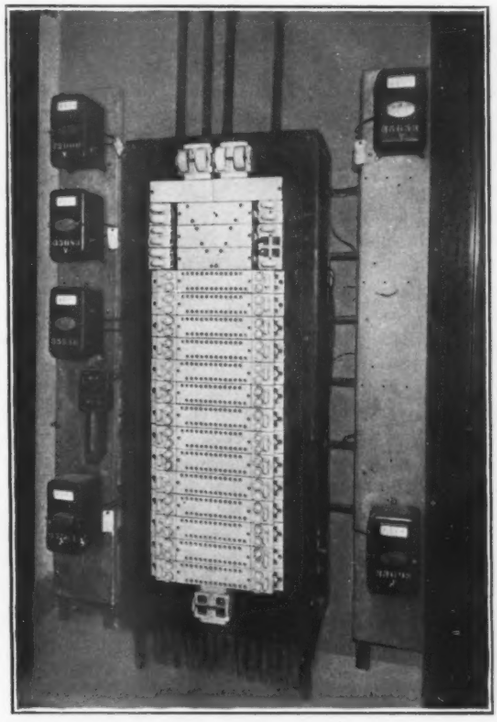
The present sand-pumping load has been almost continuously on the central-station company's lines during the last year, when the boulevard crowning was begun. The booster load continues twenty-four hours a day from ten to twenty days at a time, following which a day is taken to shut down, overhaul and move the machinery if necessary. The pump impellers last only one or two months under the severe service required of them in pumping the sand. At present three 250-hp booster units are in service, and the energy consumption of the North American Dredging Company of Texas, which is doing the work, has reached 365,000 kw-hours in a single month. For this service a comparatively low rate is granted, as the proposal to use central-station drive for the booster units had to compete with some very efficient isolated-plant installations. The income obtained from the dredging load, however, according to Mr. F. M. Lege, manager of the central-station company, is very satisfactory from his standpoint in view of the high load-factor of the demand, and has been of considerable advantage in improving the load conditions of his 4300-kva turbine generating station.

ELECTRICITY IN THE PEOPLE'S GAS BUILDING, CHICAGO.

The new office building of the People's Gas & Coke Company at the corner of Michigan Avenue and Adams Street, Chicago, is a monumental structure of granite, steel, concrete and tile twenty stories high and occupying a ground area 190 ft. x 170 ft. The main floor is used by the gas company as its business office, a corner room being leased to a banking company. The floors up to the sixteenth are occupied by office tenants, while the stories from the sixteenth to the twentieth are used by the gas company for its general and executive offices, employees' restaurant, etc.

While the building is architecturally and structurally one of the most modern and imposing erected in Chicago, the fact of its ownership by the gas company has resulted in the use of gas for illuminating purposes wherever possible. The business offices of the gas company are lighted entirely by gas, the office-building corridors are equipped with inverted incandescent-mantle fixtures, and the tenants' offices are arranged with combination fixtures combining gas outlets for indirect illumination and direct electric lighting. Although efforts were primarily made to have the tenants rely on gas for illumination, it is significant that three-fourths of these offices are now lighted entirely by electricity.

The fixtures for the People's Gas Building were all of special design and from a gas standpoint incorporate a number of new ideas. The fixtures in the offices comprise three upright-mantle gas burners shaded by a reflector and projecting their light flux upward onto a porcelain ceiling plate, from which the room is lighted indirectly. This ceiling plate performs the double function of reflecting the light rays and also providing a surface, easily cleaned by wiping, designed to collect the soot and dust carried in the heated-air columns rising from the burners. Even with the ceiling plates, however, the plaster suffers



Meter Panel Installed in the People's Gas Building, Chicago.

noticeable discoloration at the margins of the porcelain. The lower sides of the indirect-lighting reflectors are of amber-colored art glass, combining a limited amount of direct lighting with the indirect. These indirect-lighting fixtures were provided to avoid the necessity for desk-lamp hose connections in case gas was generally used for illumination. Pending from the reflector of each ceiling fixture is a cluster of three lamp sockets. As above noted, the majority of the tenants now use electricity for lighting. The entire building is completely wired for electricity, including the concealed outlets in the gas company's own offices, where fixtures have not been installed. The distribution boards employed on the office floors, four to each story, are of the New York type with porcelain-covered fuses and represent the first installation made of this kind of board in Chicago. The main fuses are shown at the top of the board. Below them are the connections to the vertical meter buses, while each branch circuit is fed from transverse-threaded buses which by means of special screws inserted through the holes shown can be connected to the meter bus desired. The entire bus structure is covered with porcelain and all fuses are porce-

lain-inclosed. These meter panels were built by the Metropolitan Engineering Company.

The corridor lighting is done by specially designed mantle fixtures in which all openings and vents for the primary and secondary air and for the discharge of the products of combustion are concealed. These lamps are equipped with pilot flames and pneumatic valves controlled through double tubing from junction boxes. To light or extinguish the lamps the attendant inserts a little pocket pump into the "on" or "off" tube terminal, operating the valves at the jets as desired. In case of injury to one of the tubes the system can still be worked by exhausting and compressing the air in the remaining tube.

Altogether there are 6840 pilot flames burning continuously in the building. The outages have averaged only about two a month according to Mr. C. A. Luther, illuminating engineer for the gas company. Mr. Luther designed a number of the gas fixtures in the building, and on May 18 read a paper describing its lighting before the Chicago Section of the Illuminating Engineering Society following an inspection of the building by members.

The main office of the gas company on the first floor is finished in red and white Grecian marbles and as a business interior is probably unsurpassed in size or beauty by any banking room in the country. The principal lighting is done by twenty-two high-pressure single-mantle gas units ranged about the border of the room. These chain-suspended fixtures are of unusual beauty and are made of solid brass, each weighing 500 lb. The burners are suspended 18 ft. above the floor and 12 ft. below the ceiling, and are placed at 15-ft. intervals. The center of the room is lighted by 11-ft. vertical bronze candelabra, each carrying four low-pressure mantle burners. All of the tellers' cages, offices, etc., are equipped with individual inverted lamps. An attempt was made to use gas lamps in the vaults of the gas-company's office, but after an earnest effort the gas units were abandoned and electric lamps substituted. The office is completely wired for electricity, but all outlets are concealed and no use is made of electric lighting except in the instance mentioned.

Between the huge granite columns along the Michigan Avenue and Adams Street fronts of the building are twenty-two high-pressure single-mantle units similar to those in the main office. The gas pressure for these forty-four lamps is raised from the city-main pressure, 3.5 oz., to 2 lb. per square inch by a pair of 4-hp motor-driven blowers installed in the building. One blower is ordinarily in use, but the connections of the second are so arranged that in case of interruption to the first unit the second blower will automatically start up. The high-pressure gas lamps are arranged with thermostat valves which admit the gas slowly to the burner as it warms up, full brilliancy being reached about one minute after the gas is turned on. This partial admission of the gas supply prevents the noise and miniature explosions which would injure the mantle in case the high pressure were turned on full at once. The high-pressure burners show a light-producing efficiency two or three times that of the low-pressure burners, and give 67 cp-hours per cubic foot of gas per hour.

The People's Gas Building is equipped with fourteen electrically operated elevators, and motor drive is used for many auxiliary purposes in the building, including water pumping, refrigeration, etc. No gas engines are used in the building, the original plan to install a gas-operated isolated electric plant having been abandoned in favor of the purchase of electrical energy from the Commonwealth Edison Company.

CENTRAL-STATION DEEP-WELL PUMPING FOR SMALL-TOWN SUPPLY.

The water supply for the town of Coalgate, Okla., 4000 population, is lifted from 250-ft. wells by one 50-hp motor-driven compressor supplying air-lift pumps, and one 15-hp deep-well pump. The reservoir level is maintained by a 25-hp centrifugal pump capable of delivering 300 gal. per minute. Tests made by Mr. H. L. Reager, manager of the local central station company, show that about 1.25 watt-hours are required by the deep-well pump for every gallon lifted. As this means a considerable saving over the air-lifts, the town has decided to replace the latter by deep-well pumps. The pumping station is 5 miles from the town and the power house, and the attendant who takes care of the pumps augments his income by farming. All of the motors are 2300-volt machines. Ordinarily the pumps are operated from 3 p. m. to 5 p. m. and for several hours in the early morning beginning at 12 midnight. The town pays 4 cents per kw-hour for its pumping service, from which the central station derives an income of about $500 a month.

Wiring and Illumination

UNIT LIGHTING SYSTEM IN A SMALL OFFICE.

The illuminating engineer who recommends the overhead, so-called "unit lighting" system to replace local desk lighting in an office is often met with the justifiable objection that the owner does not want the entire installation burning when only

Overhead Unit Lighting of an Office.

one desk is in use. The accompanying illustration shows a factory office, 50 by 20 ft. floor space, in which the lamps on the right side of the room over the individual desks are under separate switches, while the row at the left is divided into alternate groups of two and three lamps, which serve to light the tables beneath, which are in almost continuous use.

It was first proposed to light this room by a cluster of four 60-watt tungsten lamps at the center of the ceiling, together with 12 50-watt carbon lamps, one on each desk, totaling, with a 250-watt cluster in the entrance aisle, 1200 watts. This factory office is in St. Louis, where the Union Electric Light & Power Company tenders its customers the expert advice of its illuminating engineer, Mr. John F. McGlensey. Mr. McGlensey advised against the desk-lamp installation, and suggested that shown, which was carried out with a connected load of only 720 watts in tungsten lamps, and at a cost for wiring less than for the desk-lamp outlets. Twelve 60-watt tungsten lamps were installed 10 ft. above the floor, in intensive reflectors, as shown. The lamps are approximately 5 ft. or quarter way out from the walls, with 10 ft. between lamps. The intensity at the working plane is designed to be 3.5 ft. candles.

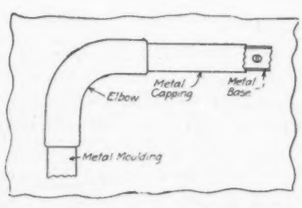
The desks on the right-hand side of the room belong to individuals who are absent much of the time, and each of

the lamps in the row is controlled by a switch in the group at the far corner, so that any lamp can be switched off by its user as he leaves the door at the right. The seven wires required for these six lamps were easily carried in the 1-in. conduit concealed under the metal ceiling. The tables at the left are in use almost continuously. The alternate lamps on this side are accordingly arranged in two groups, so that either or both can be switched on, depending on the general illumination required in the room. Both the owner and his employees are well pleased with the uniform illumination afforded by the overhead system. The uniform quality of this lighting is shown in the illustration, which was made from a night photograph of the room. The actual watts expended in the room also represents a saving of about 40 per cent over the amount required for carbon desk lamps.

ERECTION OF METAL MOLDING.

By A. G. Tonstead.

Right-angle turns in metal molding runs are ordinarily made with metal-molding elbow fittings, as shown in Fig. 1. A more sightly turn can be made, without elbow fittings, as suggested in Fig. 2, by mitering the capping and base in much the same way as wooden molding would be mitered. The miter is cut with a hack-saw. A miter-box can be used to guide the saw



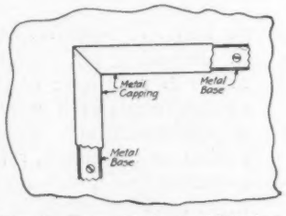


Fig. 1—Turn Made with Elbow. Fig. 2—Turn Made by Mitering.

or the cut can be made quite satisfactorily by laying off a distance, *W*, Fig. 3, equal to the width of the capping or brace, as the case may be, along its side and indicating it with a pencil mark. The saw cut should be made connecting the corner of the molding with the pencil mark. After a wireman has done a little mitering he can judge, with his eye, the angle that the cut should take and can dispense with the miter-box and the marking. Metal molding is flexible enough to let it be bent to meet at mitered corners if the cutting is a little inaccurate.

In somewhat the same way that turns are made elbows can be formed. Fig. 4 shows the usual method where fittings are used and Fig. 5 how it can be done by mitering. It is required by the National Electrical Code (Rule 25 A d) that metal molding be so installed that adjacent lengths of molding will be mechanically and electrically secured at all points.

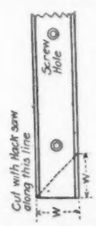


Fig. 3—Method of Laying Out a Miter Cut.

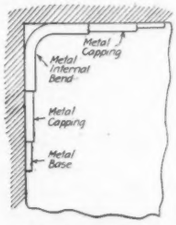


Fig. 4—Elbow Formed with Fittings.

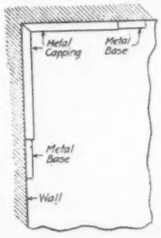


Fig. 5—Elbow Formed by Mitering.

Where work is subject to Underwriters' inspection connecting pieces, cut from scraps of molding, can be inserted as outlined in Fig. 6, to join electrically and mechanically adjacent lengths together. Where molding is being erected on a wooden surface flat-head wood screws can be used for supporting it and for effecting the connection between the conducting piece and the base pieces. (It is required by the code [Rule 25 A c] that the heads of any bolts or nuts used must lie flush with the interior face of the base, after they have been inserted.) On concrete surfaces screws, turning into expansion anchors, or stove bolts can be used and toggle bolts or stove bolts can be used on tile fireproofing. Where stove bolts are utilized small cavities must be chipped in the supporting surface to accommodate the nuts, but it is often more convenient to chip

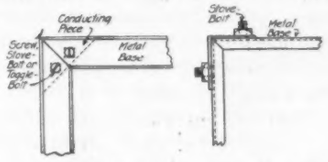
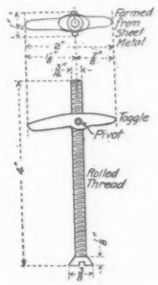


Fig. 6—Application of Conducting Pieces.

these holes than to drill for an expansion anchor or a toggle bolt.

Toggle bolts, of the form detailed in Fig. 7, are well adapted for fastening metal molding to tile fireproofing. The bolt itself is threaded its entire length. The toggle is pivoted eccentrically and the long end tends to lie close to the bolt, while it is being inserted, as shown in Fig. 8. After the toggle is through the hole it can be thrown into a horizontal position by twirling the bolt or by jiggling it up and down. Two sizes of toggle bolts are used for supporting molding. The ¼-in., that shown, is very satisfactory. The other size, 3/16 in., is a trifle light for all around work. A length of 4 in., as suggested in Fig. 7, is about right for the average condition.

All holes drilled for supporting screws or bolts in metal molding base should be countersunk. A special bit for this



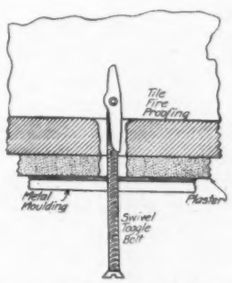


Fig. 7—Toggle Bolt for Metal Molding. Fig. 8—Toggle Bolt Being Inserted.

work, having a square shank which fits the ordinary brace, is available. It is a combination drill and countersink, in that it drills and countersinks at one operation, and is a convenient tool. The base is usually drilled and countersunk by its manufacturers to accommodate No. 8 wood screws. These have a diameter of a trifle over 5/32 in., about No. 6 B. & S. gage.

RECENT TELEPHONE PATENTS.

SUPERVISORY SYSTEM.

With two-wire common-battery switchboards it is customary to use four supervisory relays to effect a complete system of supervision. The usual arrangement splits the cord pair as to answering and calling, but includes a condenser in each cord strand. The battery can thus be supplied to each cord independently. In a system just patented by Mr. N. C. Schellenger, of Chicago, however, the battery is supplied through the four relays, one relay being associated with each strand of each cord. When the hook is up at a station to which the cord is connected, both relays are in circuit, one being operated to close the circuit of the supervisory lamp, while the other opens this circuit, so that the lamp is not lighted. If now the hook be depressed, the circuit-closing relay has its operating current maintained through the grounded bell at the station. But the circuit-opening relay is de-energized because its circuit is broken at the hook switch. Thus the supervisory lamp cir-

cuit is closed and the lamp lights. The patent is assigned to the Stromberg-Carlson Telephone Manufacturing Company.

REPEATER SYSTEM.

A repeater system employing mechanical rotation as the source of the relaying energy, through the use of a unipolar dynamo, has been patented by Mr. C. G. Ashley, of Chicago. The patentee arranges his dynamo with an exciting winding, preferably supplied with a uniform current from a battery. This field is then modified by an auxiliary winding which carries the received telephone current. The cup-shaped armature traveling in the field has generated in it a reinforced duplicate of the telephone current, the regenerated current being delivered through a step-up transformer to the telephone line.

TELEPHONE RECEIVER HOLDER.

Mr. C. L. Williams, of Parkersburg, W. Va., has obtained a patent for a receiver-supporting device, which takes the form of a "lazy-tongs" or multiple pantograph, with a receiver clamp at its outer end. Switch springs are arranged so that the circuits are changed as required as the arm is extended or shut. If desired, a counterbalance may be arranged opposite the receiver so that the telephone set will not be overbalanced.

IMPROVEMENTS IN REPEATERS.

Some five years ago it was first realized that the mercury-vapor arc could be utilized as a telephone repeating apparatus. The received current was led through an electromagnet, the feed of which cut the arc. This varied the arc resistance correspondingly and the arc thus became impressed with a counterpart of the received current. Mr. Peter Cooper Hewitt, of New York City, at that time obtained a patent for such an arrangement.

Now he has discovered a second means of utilizing the vapor arc as a means of repeating, and he has recently obtained a patent for this invention.

It is well known that the surface of the positive electrode of such an arc is continually broken or disturbed by one or more protuberances. Mr. Hewitt has found that these protuberances present an interference to the positive current flow, and that their effect in this regard may be varied by the action of a magnetic field. It is thus evident that variations of current flow may be impressed upon the arc circuit, corresponding to the field variations of the disturbing magnet. This patent is assigned to the Cooper Hewitt Electric Company.

Mr. C. A. Kruckow, of Germany, has also obtained a patent relating to repeaters. Here the object is to associate two repeating instruments with a single two-way line in a manner such that a two-way conversation may be carried on. The repeaters must, of course, be so arranged as to be mutually non-responsive, and this is accomplished by the use of four triple-wound induction coils with windings so arranged that the receiving part of each repeater is in a neutral position with respect to the reinforced currents from the other.

EXCHANGE SYSTEMS.

Mr. H. P. Claussen, of Chicago, has obtained a patent for a circuit system for common-battery exchanges which requires a three-wire plug and cord and a three-wire jack. The line relay is connected between tip and ring at the jack, while the supervisory relay is similarly connected in the cord. The line relay is of high resistance and is shunted out by the low-resistance supervisory relay.

An automatic exchange system forms the subject of a patent recently issued to Mr. A. T. Brown, of Syracuse, N. Y. He makes use of a motor-driven connecting device having thirty movable contacts arranged upon a moving carriage. These contacts are uniformly spaced with a center-to-center distance, the same as that of thirty groups of stationary contacts. A single step of the rack puts the thirty movable contacts over No. 1 stationary contact of the corresponding group. At will any movable contact may in this way be selected and brought into operative position. Sixty impulses on the line will thus give direct selection of any one of 900 lines.

NEW APPARATUS.

An improved plug seat is the subject of a patent granted to Messrs. J. J. Taylor and L. K. Hoss, of Cherryville, Kan. The usual plug seat comprises a small brass plate with a perforation which will admit the switchboard cord, but not the attached plug. Therefore, the whole length of cord must be drawn through the seat in installing or replacing it. According to the present invention, a small metal sleeve, too small to admit the plug, is mounted loosely upon the cord, and a notched strip of metal is arranged at the base of the plug socket to receive, support and retain this sleeve. The plug socket must, of course, be widened at its base to permit the cord to be thrown out of line sufficiently so that the sleeve can be seated above the notched strip of metal.

The patent of Mr. S. A. Koltonski, of Boston, describes a transmitter. The face of the instrument is removable, exposing a frame which carries the diaphragm and bridge. A clamp ring fits into the face of this frame in such a manner as to clamp a moisture-proof celluloid diaphragm in front of the operating diaphragm.

Letters to the Editor.

Indirect Lighting vs. Gas.

To the Editor of Electrical World:

Sir:—In reading Mr. Norman Macbeth's reply of April 20 to my article in your issue of March 30, it seemed to me as if the overstatements in it were sufficient to make any rebuttal on my part unnecessary. However, several other journals have since taken up the matter, referring to Mr. Macbeth's impressions of what I said, instead of going back to my original article, hence attention should be called to the difference.

Thus, my reporting the reasons why the indirect-lighting equipments actually tried by an enterprising manufacturer had not proved a success, and my referring to these reasons as present shortcomings, is quoted as a conclusion "that gas cannot be used for indirect lighting." Moreover, I am blamed for referring to the vitiation of air by gas, although no reference whatever had been made to it in my article.

That manufacturers of gas equipment have not the time to devote to indirect-lighting systems is an easily made excuse, it being generally customary for manufacturers to be "too busy" when asked to figure on work on which they know they would be outclassed. I was long in the manufacturing business myself. The fact that my article was based on the comments of a "manufacturer of lighting fixtures eager to cater to the large gas interests" should answer that point. Personally, I presume that some day this same manufacturer may be able to adapt his fixtures to gas, for I am an optimist. However, my article was based on the present situation, the present handicaps; hence any one taking Mr. Macbeth's letter seriously should read what I actually said.

Chicago, Ill. Albert Scheible.

Visual Acuity.

To the Editor of Electrical World:

Sir:—In the account given in your issue of May 11 by Dr. Louis Bell of the results of a highly instructive research on the subject of "Chromatic Aberration and Visual Acuity" he substantiates the findings which were presented by the writer in an article in your issue of Feb. 25, 1909. In this latter article were given the results of a very careful research on the subject of "Physiological Optiques," extending over a considerable period, during which time the subjects of "Glare," "Visual Acuity," "The Validity of the Flicker Photometer" and many other subjects which have recently been under discussion were investigated.

In the article by Dr. Bell he notes that the acuity increases with the shorter wave lengths, which he attributes to chromatic aberration of the eye. In this connection the writer would like to call attention to a paper presented by him before the Boston Section of the Illuminating Engineering Society in May, 1909, on "The Physiological Effects of Illumination." It was noted that with the shorter wave lengths, such as produced by the mercury-vapor tube (pages 417, 418 and 419), a sharp contraction of the pupil was produced, which effect has been also noted by MM. Broca and Laporte in their very interesting research report in the *Bulletin* of the Société Internationale des Electriciens, June, 1908. This fact may also be readily noted by any one who may stand near the mercury-vapor tube, allowing another to gaze at the pupil of his eye. A sharp contraction will be noted.

In the published results of the writer's observations the conclusion was drawn that this sharp contraction probably accounts for the high acuity which is produced by the short wave lengths, the pupil of the eye acting as a diaphragm to a camera, in which, if we desire to obtain a sharp, clearly defined negative, we always use a small stop in taking a photograph. Why the pupil should contract to such a marked degree under the mercury-vapor tube it is difficult to explain. It is certain, however, that in so doing nature is exercising some protective agency to the retina of the eye. Whether this is due to the deleterious effects attributed to the shorter wave lengths of the mercury-vapor tube it is hard to say, but the fact remains that nature does cause a much sharper contraction of the pupil for a given intensity of mercury-vapor lighting than it would for the same intensity from light sources giving a more normal spectrum.

Harrison, N. J. SYDNEY W. ASHE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Free Oscillations of Synchronous Alternators.—L. DREYFUS.—In the investigation of the phenomenon of the surging of alternators the so-called "forced" oscillations have been chiefly considered in the past. There may also be free ("self-exciting") oscillations. These are produced when the frequency is low, when the excitation of the machine is high and when the ohmic resistance of the magnet winding, together with that of the series regulator, is high. The author investigates this phenomenon mathematically and shows first that an ideal synchronous machine which has no stray fluxes and in which the ohmic resistance of the phases is negligible is incapable of producing such self-excited free oscillations. In the main part of the paper the author, therefore, takes into consideration the ohmic resistance of the windings and partly also the stray fluxes. He shows that the "synchronizing force" of the machine when running without surging at a low frequency is considerably influenced by the ohmic resistance of the phases and the value of the direct-current excitation. The author discusses especially how the limit of stability of running depends on the degree of over-excitation. He also shows that the law of damping of a synchronous machine at low frequency is quite different from the law usually assumed and that the damping effect of the ohmic resistance of the windings becomes of more importance the higher the over-excitation. The free self-excited oscillations can be best suppressed by means of a short-circuit winding of as ample dimensions as possible, arranged in the axis of the "cross flux" (synchronous machine with cross-flux dampings). The effectiveness of this remedy has been proved by experiments and its theory is given at some length.—*Elek. u. Masch.* (Vienna), April 16 and 23.

Voltage Between Commutator Segments.—T. HOOCK.—An English translation of his recent German paper in which he shows that the maximum voltage between commutator segments depends on the saturation of the magnetic circuit and points out how it increases in the case of a motor when the speed is raised by shunt regulation.—Lond. *Electrician,* May 5.

Unipolar Dynamos.—An abstract of a recent thesis of B. von Ugrimoff. The author considers the contact made between a rotating disk and mercury. A long series of experiments was made with different arrangements of this liquid contact at very high peripheral speed. It is only when water cooling is resorted to, however, that a practical solution can be found. The author built an 80-kw, 40-volt unipolar machine running at 8000 r.p.m. The conclusions of the author are as follows: A unipolar machine with nickel-steel disk armature and good liquid contacts can be made to yield pressures sufficient for incandescent lamps. The water-cooled liquid contact has proved satisfactory for collecting current at peripheral speeds which range up to 270 m per second.—Lond. *Electrician,* May 5.

Aluminum Wire for Field Coils.—M. A. MARIAGE.—A report to the International Congress of Tramways and Light Railways held in Brussels last year on the use of aluminum wire for the field coils of electric-traction motors, with special reference to the experience of the General Omnibus Company in Paris. The advantages which aluminum has over copper are pointed out.—*La Lumière Elec.,* April 29.

Circular Diagram.—R. MOSER.—A communication in which the author gives a simple graphical proof of the exact circular diagram of the three-phase induction motor.—*Elek. Zeit.,* April 27.

Lamps and Lighting.

Effect of Wall Papers on Illumination.—P. J. WALDRAM.—A paper read before the (British) Illuminating Engineering Society. Up to the present it has been customary to neglect more or less the wall and ceiling illumination and to consider the working plane illumination as being a criterion of the whole. This is not only wrong, but is injudicious. The walls are what practically every one unconsciously judges by. According as they are bright or dull, warm in tint or cold, so, rightly or wrongly, the illumination of the room is popularly classed. The light reflected by the walls and ceilings has a psychological effect. Commercially, too, the reflected light from the walls and ceilings is important. The author emphasizes that it would be important to establish standards of surface brightness which would be satisfactory for different classes of interiors. The author suggests that reflection coefficients for paper of any color or texture can be ascertained with sufficient accuracy for all practical purposes by measuring its apparent surface brightness in a direction normal to its surface, as compared with that of white blotting paper, a holophane lumeter standard card, or any other suitable standard under the same illumination. He emphasizes the importance of the use of candle-power curves of lamps and shades, and suggests the following method: To one end of a light wood lath is fixed a vertical bent plate of tin blackened and marked in degrees and carrying a plumb bob so that the angle with the horizon at which the rod is being held can be read off at once. Part of the tin plate is bent at right angles to the direction of the lath, and a plate of known whiteness—white blotting paper of a lumeter test plate—is attached by means of a rubber band. A blackened brown-paper screen is held or hung behind the lamp and shade to be tested; the lath is held with the point just touching the lamp. The illumination in foot-candles produced on the test-plate is then read with the lath held at different angles. This illumination (except in the blackened room) is produced partly by the lamp and partly by reflection from surroundings or even by other lamps. The rays coming from the lamp alone are

isolated from the extraneous light as follows: A small black screen of such a size as just to screen all the rays from the lamp and shade, but nothing else, is held in a notch in the lath and a reading taken under these conditions represents the extraneous light only. The difference between the two represents the direct rays from the lamp and shade only. The net foot-candle readings divided by the square of the length of the lath used give the required candle-power at various angles. The method gives curves which approximate very closely to those obtained in the laboratory, and it also enables curves to be measured for gas mantles, oil lamps, wax candles, etc., which are very difficult to obtain in any other way. The author refers to the exhaustive series of tests on the increase in flux due to reflection carried out by Sharp and Millar and emphasizes that it would be good to make more numerous if less detailed tests of a similar nature in a number of rooms of different sizes with different schemes of color and with varying proportions of light thrown upon walls, ceilings and floor respectively by means of light units at varying heights with various shades. The author is making a number of such tests of different rooms. The method adopted is to divide the floor, walls and ceiling into a number of equal rectangles. The candle-power distribution curves of the lamps having been measured as before described by means of a photometer, readings were then taken of the illumination received by a detached test-plate in the center of each rectangle. Then another series of readings was taken with a small black screen placed about halfway between the test-plate and each lamp so as just to cut out the direct lamp rays while obliterating as little as possible of the light reflected from the ceiling. This second test of readings isolates the increase due to all reflections and counter-reflections, and the difference between the sets of readings should equal the direct flux as calculated from the candle-power curves. —Lond. *Electrician*, May 5.

Spectral Luminosity Curves Obtained by the Equality of Brightness and Flicker Photometers.—H. E. Ives.—An abstract of an American Physical Society paper. The photometry of lights of different colors is complicated by physiological and psychological factors. These enter to different degrees in the various methods of photometry which have been employed for such comparisons. The most accurate methods available are those of equality-of-brightness and flicker photometry. In the latter the psychological element of estimation is eliminated, but ignorance of behavior of the flicker photometer under various conditions has delayed its general use. The present investigation consists of a comparison of the two methods of photometry under a wide range of conditions. Special luminosity curves have been obtained by comparing the brightness of the prism face of a spectrometer with the illumination of a white sector illuminated by a standard incandescent lamp. The sector in rotation forms the flicker photometer. Curves have been obtained for a large range of illuminations and three sizes of photometric field. It has been found that the sensibility and reproducibility of the flicker method are much greater than the method by equality of brightness. With decrease of illumination the maximum of luminosity shifts toward the blue with the method of equality of brightness (Purkinje effect); toward the red with the flicker method. With decreased size of field the maximum of luminosity shifts toward the red for the equality-of-brightness method (yellow spot effect); toward the blue for the flicker method. At low illuminations the two methods give results considerably different, but at high illuminations the special luminosity curves closely approach each other. Measurements made at two illuminations (high and low) by five different observers of normal color vision show marked differences in the position of both kinds of curves; all show the opposite shift of luminosity maximum by the two methods with change of illumination; different relative positions of the two curves at high illuminations are found with each observer, but the mean high illumination curves by each method closely agree, thereby supporting the conclusion that the methods approach equivalence at high illuminations for an average eye. A mean luminosity curve is obtained and reduced to a normal spectrum. Its maximum lies at 0.545μ. Conclusions are drawn that the standard condition for heterochromatic photometry should be a high illumination, thus permitting the use of the more accurate flicker photometer. Further investigations on problems arising in this connection are mentioned.—*Phys. Review*, April.

Metallic-Filament Lamps.—A note on a recent British patent (8984, May 4, 1911) of the British Thomson-Houston Company and J. Gray. Filaments drawn from an alloy of tungsten with another metal are strung on the carriers or spiders before the latter metal is driven out by volatilization. In order to permit of the contraction of the filament during the volatilization it is previously corrugated or crinkled.—Lond. *Elec. Eng'ing*, May 11.

Selective Radiation.—W. W. Coblentz.—A continuation of his extended researches on the selective radiation from various substances. In the present paper the author describes the apparatus and methods used by him, and then deals especially with the radiation from acetylene flame and the Welsbach mantle. Finally data are given on the problem of color match versus spectral-intensity match.—*Bull. Bur. of Standards*, May 15.

Generation, Transmission and Distribution.

Electromechanical Transmission Gear.—An illustrated description of the Thomas electromechanical transmission system for automobiles. This system differs from other systems devised to give a wide speed variation by means of electrical machines in that there are two distinct paths of power between the engine and the load shaft—one mechanical and the other electrical. This arrangement is obtained by means of planetary gear in conjunction with two small electrical machines. These units are so arranged that the greater proportion of the engine power is directly transmitted mechanically. Fig. 1 shows the

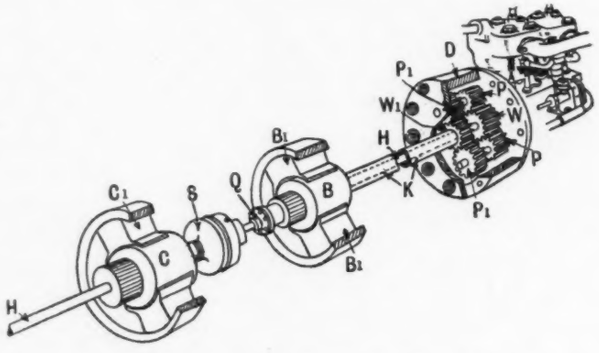


Fig. 1—Electromechanical Transmission Gear.

arrangement. The casing D forms the flywheel of the engine and is directly coupled to it. Inside this casing are two planet pinions P and P_1 of different diameters keyed to the same spindle. This spindle is supported in the sides of the casing and is free to rotate about its own axis. The planet pinions P and P_1 mesh with the two sun pinions W and W_1, which are rigidly connected to the independent shafts H and K. On the shaft K is mounted the armature B of an electrical machine and on the shaft H (which is the load shaft) is mounted the second electrical machine CC_1. In these two machines, BB_1 and CC_1, the field windings are in series with the armatures and are connected in series by the operation of the controller. There are thus two paths of power between the engine and the road wheels—the first a direct mechanical path from W along the shaft H and the second an electrical path from W_1 through two electrical machines to the shaft H. If W is larger than W_1, then for a certain rotation of the casing W_1 will tend to rotate backward and W forward at speeds depending upon their relative resistances to motion. It will be seen that if the speed of the casing D is constant the speed of H will vary with the speed of K, and since the speed of K depends on its resistance to motion (and, therefore, on the load

on the machine BB_1), the speed of H can be varied by changing the amount of power transmitted electrically.—Lond. *Electrician*, May 5.

Colorado Water-Powers.—W. B. FREEMAN AND E. O. CHRISTIANSEN.—A paper giving a large number of statistical data on the water-power available in Colorado. The estimated total minimum or primary horse-power of river systems in Colorado is 828,400, of which 586,300, or 70 per cent, is on the western slope. The minimum for the six high months is 1,673,100, of which 70 per cent is on the western slope, and the horse-power from storage during the six months' period is 2,560,200, of which 72 per cent is on the western slope. A list of different power plants installed in Colorado is given.—*Jour. Eng'ing*, Univ. of Colo., No. 7.

Traction.

1200-Volt Trolley Line.—A fully illustrated description of the 1200-volt equipment of the Shore Line Electric Railway, which follows the Connecticut shore of Long Island Sound for a considerable portion of its length. Three-phase 11,000-volt energy is transmitted at 11,000 volts to two substations in which the emf is reduced to 370 volts and then the current is converted to direct current at 1200 volts, which latter pressure is used on the trolley. Each car is equipped with four 50-hp interpole motors wound for both 600-volt and 1200-volt operation. The cars operate at 600 volts in New Haven and at 1200 volts on the interurban section.—*Elec. Ry. Jour.*, May 20.

Single-Phase Traction.—An illustrated article on the single-phase electrification of the London, Brighton & South Coast Railway.—*Elec. Ry. Jour.*, May 6.

Installations, Systems and Appliances.

Statistics of Swiss Electrical Industry.—Extracts from statistics prepared by the Swiss Electric Society and the Association of Swiss Central Stations for 1909. The statistics refer to 675 stations which sell electrical energy. Two hundred and twenty-eight stations have their own generating plant, sixty-four stations buy part of their energy from other stations, while 383 stations buy the whole energy from others. Of these stations which have their own generating plants complete data are available from only 176 stations. Of these, ninety stations are pure water-power plants with a rating of 11,426 kw, or 40.5 per cent of the total. Sixty-six are combined water-power and steam stations with a rating of 156,612 kw, or 57 per cent of the total. Five stations are operated by steam only with a rating of 1012 kw (0.4 per cent). Thirteen stations have internal-combustion engines (1280 kw) and two stations have steam and combustion engines (4500 kw). The largest rating of a station is 31,380 kw. There are fifty-eight stations from 100 kw to 500 kw and sixty-one stations with ratings below 100 kw. Seventy per cent of the total equipment rating is installed in plants with more than 5000 kw. The first cost for sixty-one stations with ratings below 100 kw was, on the average, $599 per kilowatt, while the average for the stations above 1000 kw was only $240 (the figures in the latter case varying between $168 and $334). Compared with respect to the type of prime movers the first cost per kilowatt was $191 for water-power plants, $279 for combined water and steam plants, $480 for pure steam plants and $595 for gas-engine plants. Nineteen and three-tenths per cent of the plants generate direct current only, 66 per cent single-phase or polyphase currents, 15 per cent both direct current and alternating current. Fifty-three per cent of all long-distance lines are on the three-phase system, 4 per cent on the two-phase system, 32 per cent on the single-phase system and 12 per cent carry direct current. The maximum emf for long-distance lines is 50,000 volts (Brusio) for alternating-current transmission and 25,000 volts (St. Maurice to Lausanne) for direct-current transmission systems.—*Elek. u. Masch.* (Vienna), April 16.

Battery Economics.—An account of the discussion which followed the paper of Taylor recently abstracted in the Digest. B. M. Jenkin thought one of the most interesting points was the comparison made beween the ordinary battery booster and the author's suggested arrangement. That method of working might be carried still further, since the chief object of the battery was to give the maximum possible discharge when it was most needed. So long as the booster was used to assist the battery to discharge, some energy would be used in the booster when it was of most value for the load. He suggested that the absence of the booster during discharge was the point to be aimed at, especially if the battery was to be regarded as a standby. The speaker suggested the use of regulating cells on a battery with a sufficient number of cells to take the discharge. He outlined the following arrangement: The booster was placed in parallel with the regulating switch circuit, as indicated

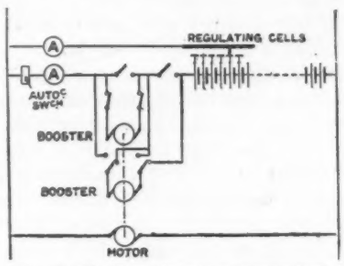


Fig. 2—Battery Booster Connection.

in Fig. 2. During charge the whole of the cells were equally charged through the booster. The regulating switch was adjusted to suit the busbar volts, and the booster voltage was adjusted to give the required charge and at the same time keep the current through the regulating switch circuit at zero. During normal discharge the same method was followed, so that all the cells were equally discharged. During the beginning of the discharge the booster was run inverted and the motor delivered energy to the busbars. At the end of the discharge the switch was on the end cell and the booster shut down. In emergency the heavy discharge was taken through the regulating switch circuit and the booster was automatically cut out as the switch was moved to the end cell. The regulating switch circuit was available for emergency discharges at all times, and was not affected by the booster connections, which might be set with armatures in series or in parallel, charging or discharging. C. E. C. Shawfield said he had formerly believed a booster to be the best and most economical means of charging and discharging a battery. But in Continental Europe the opposite opinion is held. He found switches in the Berlin Electricity Works which were "really wonderful in their simplicity and certainty of operation." He saw one move over several contacts when carrying 4000 amp and, although that particular switch had been in service seven or eight years, the contacts appeared absolutely new. He was assured that they had not required any repairing or renewals during that period. In regard to the cost of regulating switches, it did not appear to be any higher than the cost of the boosters. He thinks that the efficiency to be obtained by the use of regulating cells is very much higher than is possible with boosters. The rating of the batteries installed in the Berlin Electricity Works was 35,000 kw on the two-hour rate, and in case of breakdown they were capable of maintaining the whole supply of the city for a period of two hours. It was considered necessary to make such a large provision in the way of batteries because they result in considerable economy in coal, which is expensive in Berlin. Further, the supply company is under very heavy penalties to the local tramways, to the underground railways and to the municipality in the event of any failure of supply. The batteries installed afford insurance against the heavy liability for breakdowns. Such a state of affairs, however, does not exist in England. S. L. Pearce gave data on the large batteries installed at Manchester. He said that it is not true that the coal bill has been reduced by some 25 per cent. It was true in three months in the summer of last year, but the average for the completed twelve months is only 13 per cent. The long reply of Taylor is also given.—Lond. *Electrician*, May 5.

Triple Harmonics in Transformers.—W. W. LEWIS.—A paper illustrated by diagrams in which the author explains some of

the facts accompanying the presence of triple harmonics in transformers and draws some practical conclusions therefrom. No-load conditions only are considered. He reaches the conclusions that to produce proper conditions in operation a three-phase transformer or a bank of three single-phase transformers should always be operated with a closed delta in either the primary or the secondary, or if operated with both sides star-connected the neutral of the side receiving the energy should be connected either metallically or through ground to the neutral of the source of energy. He also concludes that transformers will operate safely in open delta as far as magnetizing is concerned.—*Journ. of Eng'ing,* Univ. of Colo., No. 7.

Wires, Wiring and Conduits.

Resistance of Copper Wires.—F. H. Millard and H. K. Humphrey.—The authors suggest the following simple method for determining with a slide rule the resistances of copper wires when in the absence of suitable tables approximate resistances of wires in ohms per 1000 ft. are desired. To find the resistance subtract ten from its number (B. & S.) and divide by ten. Regard the result as the logarithm of the required resistance, which may be found by taking the antilogarithm on a slide rule. The error of this rule is said to be less than 2 per cent for wires larger than No. 20.—*Jour. of Eng'ing,* Univ. of Colo., No. 7.

Insulated Aluminum Cables.—Although aluminum is now being used extensively for overhead conductors, it has so far been little employed for underground mains, partly on account of the increased size of cable necessary (which is, however, to some extent offset by the reduction of weight) and also because of the difficulty of making satisfactory joints in such cables. However, methods of manufacture have been improved and the reduction in the price of aluminum has changed the situation considerably, so that aluminum cables, according to the London manufacturer, can compete with paper-insulated, lead-covered

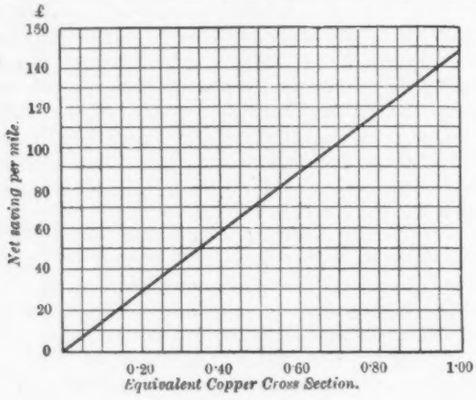


Fig. 3—Diagram Showing Saving by Using Aluminum Cables.

copper cables. Fig. 3 has been prepared to illustrate the saving which, it is claimed, can be effected by the use of lead-covered, paper-insulated aluminum cables as compared with copper cables of equal carrying capacity. The saving is based on a cost of raw copper at $300 per ton and of aluminum wire at $466.66 per ton.—Lond. *Electrician,* May 5.

Electrophysics and Magnetism.

Effect of Pressure on Electric-Furnace Spectra.—A. S. King.—An abstract of an American Physical Society paper. An electric-resistance furnace was used to observe the effect of pressure upon spectra. A graphite resistance tube of 0.5 in. inside diameter and 12 in. long, 9 in. being heated, contained the metal to be vaporized. The compressed gas was carbon dioxide at pressure ranging from 6 atmospheres to 15 atmospheres. The furnace has proved very efficient in showing the shift of spectrum lines, which are of good quality for measurement. The shifts are toward the red and of very different magnitude for different lines. The relative displacement of lines in the iron spectrum follows very closely that observed for the arc under pressure. The magnitude of the displacement, however, is much larger for the furnace than for the arc under the same pressure. It was found possible to obtain different shifts of furnace lines for the same pressure by varying the conditions of the luminous vapor. These changes, as well as the general differences between the furnace and the arc, have not as yet been traced either to difference of temperature or of vapor density, although an increase of temperature was found to bring the shifts nearer those of the arc. The luminous vapor in the furnace appears to offer less resistance to the displacing influence of pressure than is offered by the vapor in the arc. A fundamental difference in the two sources is found in the fact that in the furnace the compressed gas is heated to the same temperature as the particles of radiating metallic vapor, which cannot be true to the same degree for the discharge conditions of the arc.—*Phys. Review,* April.

Fundamental Principles of Physics.—W. Nernst.—A translation of a discussion of certain fundamental principles of modern physics under the following headings: Experiment and generalization by hypothesis, sphere of the validity of the laws of nature, system of measurements, indestructibility of matter, transformation of matter, transformation of energy, molecular hypothesis, atoms and molecules, classification of natural phenomena.—*Jour. Frank. Inst.,* May.

Electrochemistry and Batteries.

Primary Battery.—A note on a recent British patent (207, May 4, 1911) of A. Heil. Instead of using dioxide a depolarizer in the form of a dark-brown hydrated oxide of manganese mixed with graphite is employed, the whole being placed in a porous cell with solid carbon and with zinc for the other electrodes, which dip into a solution of ammonium-nitrate or ammonium chloride.—Lond. *Elec. Eng'ing,* May 11.

Units, Measurements and Instruments.

Determination of Melting Points.—C. W. Kanolt.—An abstract of a paper read before the American Physical Society. The melting points of a number of very refractory substances, including magnesia and alumina, have been determined by means of heating curves or cooling curves obtained with the Holborn-Kurlbaum optical pyrometer. The substances were heated in an Arsem graphite resistance furnace, usually in a vacuum. A pyrometer was sighted through a glass window in the top of the furnace. A correction was applied for the reflection and absorption of the glass. This correction was small and could be determined accurately. The substance to be melted was placed in a crucible of graphite, tungsten, platinum, magnesia or kaolin, with a cover provided with a hole about 3 mm in diameter. The pyrometer was sighted into the inside of the crucible through this hole, thus obtaining black-body conditions. In case the substance was likely to be contaminated by the carbon or other substances in the furnace it was placed within a tube of magnesia or kaolin, which was connected by a nearly air-tight joint to the top of the furnace in such a way that the pyrometer could be sighted down the tube. Sometimes two concentric tubes were used. In case it was necessary to avoid any trace of the carbon monoxide produced from the graphite heater a feeble current of air was admitted to the magnesia or kaolin tube and allowed to pass out through the porous walls of the tube into the furnace, the pressure in the furnace being kept down to 2 mm or 3 mm of mercury by running the vacuum pump continually. Usually about 5 grams of material was employed, although good results have been obtained with ½ gram. Successive determinations upon the same substance usually agreed within 5 deg. As a check the method has been applied to a number of those substances whose melting points are most accurately known, and the results obtained are in close agreement with the generally accepted values.—*Phys. Review,* April.

Exploring Interior Composition of the Earth.—H. Lowy.—An illustrated article in which a brief description is given of a method of investigating the interior of the earth due to experimental researches by the author and G. Leimbach. This is based on the use of electric waves, whose course will depend

upon the character of the rocks in the strata traversed. That such a method has not been used previously is probably due to the idea that the earth is too good a conductor to give measurable results.—Lond. *Electrician,* May 5.

High-Tension Condenser.—A note on a recent British patent (15,873, May 4, 1911) of W. & R. Bullimore and A. C. Crosser. This is a method for the prevention of sparking from the inner to the outer conductor, as is usual in condensers where thin dielectrics are employed. It consists of a septum, with a central aperture, preferably of the same material as the dielectric, being placed in a suitably shaped vessel closed at one end, at a point so that the inner conductor terminates near the central aperture of the spectrum, while the outer conductor is carried up past the septum, thus separating the conductors sufficiently to prevent sparking. Instead of the septum inside a flange outside can be used, when the inner coating would be extended beyond the flange.—Lond. *Elec. Eng'ing,* May 11.

Telegraphy, Telephony and Signals.

Coupled High-Frequency Circuits.—L. W. AUSTIN.—A paper describing some experiments with coupled high-frequency circuits. The results obtained by the author have a practical bearing as they show that for the greatest efficiency in working the apparatus must be so arranged that the amount of energy withdrawn from the antenna may be varied until the point of maximum effect is obtained. If the detector is connected in shunt across an inductance the number of turns contained between the detector terminals should be variable and independent of the number of turns of the inductance which are used for tuning purposes. If the detector is connected around a condenser it should have in series with it a small variable condenser which can be used to regulate the amount of energy flowing into the detector. By far the simplest and best method, however, is the inductive coupling of the untuned detector circuit to the antenna or to an intermediate tuned circuit, the coupling coils being arranged so as to be easily moved toward or away from each other by means of a rack and pinion or some similar device.—*Bull. Bur. of Standards,* May 15.

Miscellaneous.

Engineering Education.—J. A. EWING.—While empiricism was predominant the system of training, both in medicine and engineering, was a system of apprenticeship and nothing more. But now it is understood that the ideal training is one which comprises, in addition to means of getting experience, a properly organized course of study in the relevant sciences taught with reference to their practical application. These "applied sciences" may be broadly described as the theory of engineering. A striking feature of the engineering schools is their general likeness—the substantial uniformity in methods which has now been evolved. The most conspicuous difference as regards organization is that in some schools the division of engineering into branches is carried further than in others, specialization begins earlier and is more pronounced. Premature specialization means narrowness, and it is the business of the university to save the young man from that by laying foundations that are broad and deep on which the superstructure of professional knowledge will afterwards be built. In those British universities which first took up the teaching of engineering the ideal aimed at was to lay a general foundation. No attempt was made to give detailed information on professional subjects. From this ideal there has been in some instances a considerable departure; the American and Continental methods, in which professional detail occupies a large place, are now more closely approached in several British schools. The differentiation of professorships tends toward this. It allows of and practically compels a more thorough treatment of each branch, but it has serious drawbacks. There is apt to be a lack of co-ordination and balance between the various parts of the engineering school and the student who wishes a general course is not well provided for. The fundamental subjects to be taught are mathematics of the practical sort, applied mathematics, strength of materials and theory of structures, prime movers and applied electricity, mechanical drawing, surveying and experimental work in the engineering laboratory. The use of tools could be taught in a college workshop in such a way as to have solid professional value. The ordinary student of engineering must, however, look to getting his workshop experience either before or after his collegiate education. There is much to be said in favor of both plans. On the whole the advantages incline to have the practical training follow rather than precede the other mainly because the mental equipment given by the college course will make such a stage of practical training enormously more full of meaning than it can be when the pupil attacks it without preliminary knowledge of the rationale of what he has to do or sees done.—Lond. *Electrician,* May 5.

BOOK REVIEWS.

DIE WECHSELSTROMTECHNIK. By Dr. E. Arnold. Berlin: Julius Springer. 592 pages, 307 illus. and 10 plates. Price, 18 marks.

This fifth volume of Dr. Arnold's well-known series of textbooks on dynamoelectric machinery is devoted to induction machines. The chapters relate to the following subjects: An introduction; slip and torque; equations and constants of the polyphase induction machine; analytical theory; graphical theory of the polyphase induction machine; the load diagram of the polyphase induction motor, and its determination from the light-load and short-circuit tests; theory and load diagram of the single-phase induction motor; influence of harmonic fields and currents on the behavior of an induction motor; losses and efficiency of an induction motor; heating of an induction motor; starting and speed regulation of the polyphase induction motor; starting and speed regulation of the single-phase induction motor; the experimental testing of an induction motor; the design of an induction motor; examples of design; the construction of an induction machine; the applications of induction motors; the induction generator; cascade connection of two induction machines; cascade connection of an induction machine and a synchronous machine; the motor-converter; several applications of the induction machine.

The book has been prepared with great care and is well illustrated and developed. It will be of value to advanced alternating-current engineering students acquainted with the German language and interested in the theory and prnciples of induction machines.

BUILDING FOR PROFIT. By Reginald Pelham Bolton. New York: The De Vinne Press. 124 pages, illus. Price, $2.

This book is mainly directed to an economical discussion of the values of buildings as affected by land values and by depreciation, particularly on Manhattan Island. The principal item which enters into the economical question is that of depreciation and longevity in a building as a whole and in different parts of the same. Much attention is devoted to this topic. On the whole, the book tends to show that the cost of modern buildings in New York, including equipment, maintenance and especially depreciation, is considerably greater than is generally estimated. Whatever exception may be taken to the figures and percentages set down, the general reasoning must be admitted. The book will be of interest to investors, constructors, builders and building engineers.

HIGH-EFFICIENCY ELECTRICAL ILLUMINANTS AND ILLUMINATION. By Rollin W. Hutchinson, Jr. New York: John Wiley & Sons. 278 pages, 147 illus. Price, $2.50.

An elementary descriptive treatise of modern electric light-sources, including their mode of manufacture, photometry, installation and maintenance. The chapters relate to the following topics: Light and color, photometry, metallic-filament and electrolytic incandescent lamps, arc lamps, vapor lamps, fundamental principles involved in efficient and economic interior illumination, notes on street illumination. The book is written in simple untechnical language and well illustrated. It does not indulge in arithmetical relations and still less in algebra. It will be of interest to the general public and to architects, builders or engineers not directly connected with illuminating.

TÉLÉPHONIE. By Albert Turpain. Paris: Gauthier-Villars. 186 pages, 123 illus. Price, 5 francs.

An elementary description and an explanation of the apparatus and processes used in France for telephony are given in this book, which is divided into sixteen chapters, the abbreviated titles of which are as follows: Invention, the Bell telephone, the method of telephonic operation, telephone installations, military telephony, telephone networks, the telephone switchboard, multiple telephony, central battery switchboards, prepayment instruments, party lines, extension of networks, automatic switchboards, applications, long-distance telephony, conclusions. The book is intended more for the educated public than for specialists. Nevertheless, the descriptions are clear and will be useful to an elementary student of electrotechnics. It relates more especially to the telephonic service of Paris and neighboring French towns.

New Apparatus and Appliances

HIGH-VOLTAGE AIR-BREAK SWITCH.

The Railway & Industrial Engineering Company, Pittsburgh, Pa., has placed in the market the Burke high-voltage air-brake switch, whose operation is based on the fact that an arc can be extinguished on a pair of diverting horns. It is claimed that the switches will open a loaded circuit without the slightest difficulty or without causing any voltage disturbance in the system other than the normal disturbance occurring from the change of current. The switches, moreover, are so constructed that their operation will not be affected by a heavy coating of ice and sleet which might be encountered in cold weather. Fig. 1 shows a single-pole, double-throw, 25,000-volt, 200-amp switch in the closed position. It will be noted that the circuit entering the middle of the switch is carried jointly by means of a heavy blade and the diverting horns to the switch jaws and thus to the outgoing line. The shunted horns are so arranged that when the switch is closed there is considerable torsion in the center horns; thus when the switch is opened the switch blade leaves the jaws while the horns are in contact. This is shown in Fig. 2. When the switch is further opened the arc starts and extinguishes itself, due to the widening of the gap brought about by the joint action of the arc rising on the diverting horns and the switch opening. The switches are manufactured in single-pole units, each consisting of a stationary and a movable casting, as shown in Fig. 1. The stationary casting is provided with a brass bearing and the movable casting has an extended stem, part of which is accurately machined to fit this bearing, the remainder being squared off to receive a bell-crank or sheave wheel. A curved brass washer is placed between the two castings to prevent the entrance of water into the bearing. On the extended arms of each of the castings a high-voltage porcelain insulator is cemented. A sherardized iron cup of special design is placed on top of the insulators and attached thereto by special means, enabling it to be readily removed if necessary. The switch blades, horns, jaws, etc., are bolted to these cups. In order to prevent corrosion, all the screws and bolts used in the construction are sherardized. By means of bell-cranks or sheave wheels any number of these units can be connected together so as to be operated simultaneously. Between the operating handle and interconnected to these switches is placed a connecting rod by means of which the switch is safely operated from the ground, the control apparatus being properly grounded to protect the operator from danger. The switches are built in three styles for voltages ranging from 6600 to 60,000.

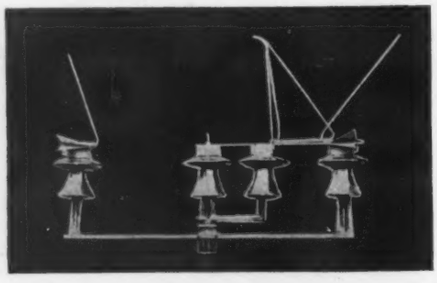


Fig. 1—Switch Closed.

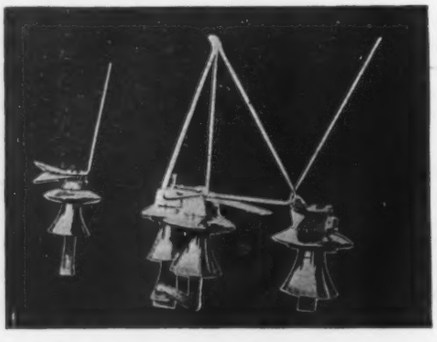


Fig. 2—Switch Opening.

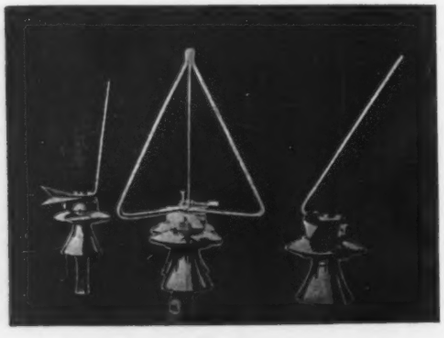


Fig. 3—Switch Open.

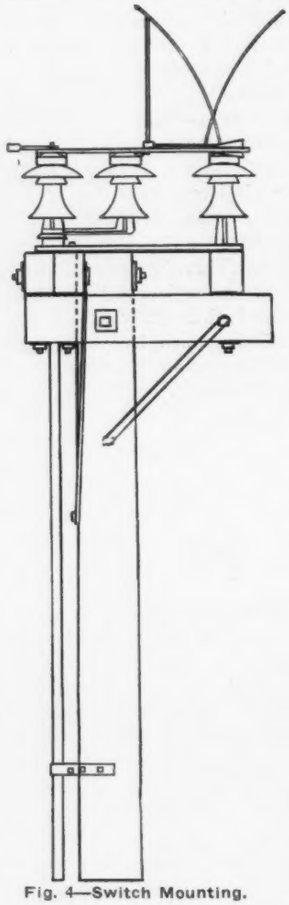
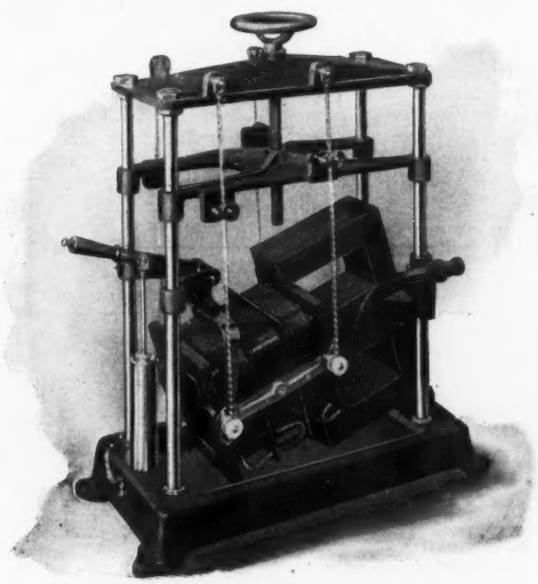


Fig. 4—Switch Mounting.

REGULATOR FOR SERIES ALTERNATING-CURRENT LIGHTING CIRCUITS.

Where a resistor is employed to effect the regulation of the current in a series tungsten lighting system the efficiency is reduced because of the constant loss of energy which results; but if a reactance is depended upon for regulation nothing worse than a lowering of the power factor results. Realizing the importance of high-power factor and close regulation, the Moloney Electric Company, St. Louis, Mo., has brought out the automatic regulating device shown herewith. The principle upon which it is based is that when a coil carrying alternating current is brought near an iron plunger it is drawn toward the plunger and as the latter enters the coil a counter emf is introduced into the circuit passing through the coil, which increases with the depth of penetration by the plunger. By applying a proper mechanical force to the coil in opposition to the force supplied to it by magnetic attraction, it is possible to adjust the counter emf so that constant current may be obtained.

As shown, the regulator rests on a cast-iron base, with four upright posts supporting a top frame and a movable plate with adjusting screw, together with a laminated core and a movable coil. Attached to guides is a lever with dashpots. The coil is wound on a shell made of hard rubber and mica, and the reactance is sufficient to maintain the current at normal value,



Regulator for Series Alternating-Current Lighting Circuits.

if all or none of the lamps are burning. In operation the lever is pushed down and secured by a ring on the end of a chain before the circuit is closed; the coil is then in the position of minimum current. The chain is next disengaged and the lever permitted to rise under the action of the dashpot, the coil automatically taking the position necessary to permit the predetermined current to pass through it. The object of the movable plate is to change the length of the supporting chains, as the shorter they are the more pull is required to bring the coil on the core. By means of the screw and hand wheel a variation of the current can be effected of from 0.5 amp below normal to 0.5 amp above normal. The manufacturer draws attention to the fact that there are no delicate knife edges to wear and no weights for adjustment. The binding posts are covered with hard-rubber sleeves so as to eliminate danger of accident to attendants. The regulator and transformers are suitable for use on 60-cycle or 133-cycle circuits and are also built for 25-cycle circuits. The transformers are of the oil type, the primary winding being designed for 2200 volts.

NURSERY MILK WARMER.

With the electric nursery milk warmer shown in the accompanying illustration and made by the Westinghouse Electric & Manufacturing Company a bottle full of infants' food will be heated to the right temperature for the baby in three minutes after the switch is turned on. Although intended primarily for

Fig. 1—Nursery Milk Warmer.

heating infants' food, the milk warmer, without the bottle, can be used for heating or boiling any liquid and is convenient for heating water for the sick-room, for shaving and for similar purposes. The water vessel holds about a pint, and this quantity of water can be raised to the boiling point in about six minutes. A heater of the immersion type is used, and as this is wholly submerged in the water to be heated all of the heat developed in the heater must be transmitted to the water. The heating element (resistor) is hermetically sealed within the walls of the copper jacket forming the heater and is thus effectually protected against oxidation. The heater has an indefinite length of life if operated on normal voltage.

By merely turning it to a position where a slot in the rim permits of its being taken out the heater can be removed from the water vessel. All parts are accessible for easy cleaning, as indicated in Fig. 2. A nursery bottle and nipple of Hygeia manufacture are supplied with each warmer. While being heated the bottle sits in a water bath and in the cylindrical heater, which, in turn, rests in the water vessel. The water bath is an important feature of the heater, as infants' food should not be burned and thereby rendered indigestible. A current tap attachment plug is furnished with each milk-warmer outfit, which screws into any Edison base lamp socket and into a socket to

Fig. 2—Showing Parts of Milk Warmer.

accommodate the plug on the milk-warmer cord. By using it the warmer and an incandescent lamp can be operated from the same outlet. The warmer takes 500 watts and operates with either alternating current or direct current.

Industrial and Commercial News

The Week in Trade.

THERE are fresh signs each week of the gradual increase in new business and of the establishment of confidence in the future. This is borne out in a large measure by the increased financing which is being done each week, and by the formulation of plans for new projects. Significant of the tone in general trade is the growth of new companies during the month of May. Charters taken out during the month by companies having a capital of $100,000 and over represented $326,144,000, as compared with $146,864,000 this April and $224,447,800 for May, 1910. These gains are due, to some extent, to the results of the Supreme Court decisions and represent a portion of the funds which were held in reserve until the necessary trend of corporate policy could be determined. With further understanding of the requirements of the recent decisions, there can be no doubt that capital will be readily attracted to new enterprises and to the development of existing industries and aid the progress of the revival movement. Results of the past week have shown a slight improvement in tone, although the actual increase in new business is not as large as had been hoped for. The continuance of warm weather has given further assistance to the retail trade, and wholesale and jobbing interests have benefited thereby. The sentiment, while cheerful, is one of reserve for future commitments. Price shading is one of the dominant factors of hesitancy, and is most notable at this time in the iron and steel trades. The reductions of the past few weeks in these have not resulted in a large volume of sales, and the outcome is somewhat uncertain. The majority of industries report sales only for immediate needs. There are continued evidences of abundant harvests, and the outlook is considered decidedly hopeful. Collections remain from slow to fair. Business failures for the week ended June 1, as reported by *Bradstreet's,* were 168, as compared with 236 for the previous week, 160 for the same week in 1910, 191 in 1909, 225 in 1908 and 155 in 1907.

The Copper Market.

DEMAND for electrolytic copper was rather better during the week than has been the case for some weeks past, and a brighter tone is reported throughout the trade. Interest has been chiefly in July and August shipments. Activity abroad continues to increase, and a fair amount of copper is being taken for use in foreign industries. Such business as has been done in this country during the week has been in small amounts and largely through second hands. Prices still hold between 12¼ cents and 12⅜ cents, delivered, thirty days. There is a general belief in the copper trade that business of the country will be revived within a short time, and that the activity will see a movement toward higher copper prices. There is further talk of a merger between producing interests, and the rumors of pending negotiations grow stronger each week. There is, further, a decided feeling that such action would be most beneficial to the copper trade and to the producers concerned. Interests in the copper trade hold that copper consolidation would be one of the most reasonable mergers possible, inasmuch as the smaller companies, which have been unable to meet competition with the larger interests by reason of higher costs of production, etc., would be able to operate at a profitable return. Provided a merger can be effected which will be in full compliance with the Sherman anti-trust law, it is thought that it will be only a matter of time until this will meet the full approval of the trade. Exports for the month, including June 5, aggregate 2921 tons. The daily call on the Metal Exchange June 5 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.85	12.05	....
June	11.85	12.05	11.95
July	11.85	12.05	11.95
August	11.85	12.05	11.95
September	11.85	12.05	11.95

The London market, June 2, was as follows:

	Noon. Highest.	Closing.
	£ s d	£ s d
Standard copper, spot	55 7 6	55 2 6
Standard copper, futures	55 17 6	55 15 0

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.30c	11.57½c
London, spot	£56 15 0	£53 7 6
London, futures	57 12 6	54 0 0
Best selected	60 5 0	57 5 0

Industrial and Commercial Notes.

Westinghouse Equipment Sales.—Among recent orders received by the Westinghouse Electric Company, Pittsburgh, Pa., are the following: For the Cosmopolitan Construction Company, Chicago, two 1500-kw synchronous motor-generator sets; for the San Francisco Gas & Electric Company, two 1000-kw synchronous motor-generator sets, and for the Edison Electric Illuminating Company of Boston, one 1000-kw generator set. The Seattle-Everett Traction Company, of Bellingham, Wash., has ordered from the Westinghouse Company a quadruple equipment of No. 304 railway motors with new non-automatic unit switch control. The Great Falls & Old Dominion Railway Company, of Washington, D. C., has purchased three quadruple equipments of No. 93-A2 railway motors with the above type of control, arranged for both rail and overhead return with special change-over switches. The St. Joseph Railway Light & Power Company, St. Joseph, Mo., has awarded a contract to the Westinghouse Company for ten single equipments of No. 307 split-frame, interpole railway motors. The Toledo & Indiana Traction Company, Toledo, Ohio, has recently ordered one Baldwin-Westinghouse locomotive furnished with a quadruple equipment of No. 304-A interpole railway motors and type L4 control. Among other recent orders for railway motor business secured by the Westinghouse Company is one from the Pittsburgh Railways Company, Pittsburgh, Pa., for fifty-three quadruple equipments of No. 306 C.D., box frame railway motors, type K 43-G control, and an additional order for 1160 single equipments of the same type of motor. The San Antonio Traction Company, San Antonio, Texas, has placed an order with the Westinghouse Company for twenty double equipments of No. 92-A interpole railway motors, type K-28 control.

Transformers for Reclamation Service.—The United States Reclamation Service invites sealed proposals at its office, in Los Angeles, Cal., for 36 single-phase, 25-cycle transformers and 41 single-phase and two to three-phase, 60-cycle transformers as follows: Four 50-kw, four 25-kw and four 10-kw transformers wound for a primary voltage of 11,000 and a secondary potential of 2300 volts; four 10-kw and four 5-kw transformers with primary winding designed for 2300 volts and secondary for 110-220 volts; four 10-kw and four 5-kw transformers with 11,000-volt primary and 110-220-volt secondary windings; four 50-kw and four 25-kw transformers Y-connected for 23,000-40,000 volts primary and 11,000 volts secondary. All the above are to be 25-cycle, single-phase transformers. The 60-cycle apparatus comprises the following: Fourteen 50-kw and three 20-kw single-phase transformers with primary wound for 2200 volts and secondary for 244-488 volts; three 25-kw, nine 10-kw and six 5-kw single-phase transformers for stepping down from 2200 to 110-220 volts; one 50-kw and one 35-kw, three-phase, 2200 to 110-220 transformer, and six 200-kw, 20,000-volt delta-connected transformers having a secondary potential of 2200 volts. The proposals will be received until 2 p. m. June 23.

Northern Electric Company of Sacramento.—In connection with the question as to the legality of franchises granted to the Northern Electric Company, in Sacramento, an ordinance has been passed by the city trustees re-enacting all grants to the traction company. The Northern Electric Company did not build its track within the time limit of the original franchises and an extension of time was granted by the city board. The question then came up as to the legality of these extensions, and in order to cover any possible legal defects the trustees were requested by the Northern Electric Company to re-enact all ordinances.

Chicago Elevated Merger Terms.—With further reference to the financing of the Chicago elevated merger reported from time to time in these columns, it is understood that the offer of purchase to be sent to the stockholders, with a request that they deposit their holdings before July 1, contains the following purchase terms: For each share of the $10,231,400, par value, outstanding stock of the South Side Elevated Railroad Co., $75; for each share of the $8,707,900, par value, outstanding preferred stock of the Metropolitan West Side Elevated Railway Company, $75; for each share of the $7,464,100, par value, outstanding common stock of the Metropolitan West Side Elevated Railway Company, $27.50; for each share of the $4,944,400, par value, outstanding preferred stock of the Northwestern Elevated Railroad Company, $70; for each share of the $4,947,100, par value, outstanding common stock of the Northwestern Elevated Railroad Company, $30. The plan further provides that all the stock required under the offer is to be transferred to a corporation which will have authority to issue participation shares. The initial issues of these will be 410,000, each with a par value of $100, 160,000 shares of these being 6 per cent cumulative preferred shares and 250,000 of common. Each depositor is to have the right to take, in place of 30 per cent of the cash payable, preferred and common shares of the new corporation on the basis that they will receive for each 100 of the 30 per cent, one preferred share and four-fifths of a common share. It has been arranged to take the stock trust certificates of the Northwestern Elevated which were issued under a voting trust agreement in 1900 as equivalent of the number of shares of preferred and common stock which are represented by these certificates.

Denver Public Utilities Reorganization.—All the companies in Denver controlled by Henry L. Doherty, through the Cities Service Company, are to be consolidated at a meeting called for July 11, under the title of the Denver Gas & Electric Light Company, with a capitalization of $10,000,000 and an authorized bonded indebtedness of $25,000,000. The purpose of the merger, as explained by William J. Barker, vice-president of the Denver Gas & Electric Company, is to retire the underlying bonds of the various concerns and to provide for future extensions. A most important phase of the consolidation, so far as the general public is concerned, is provision for the immediate renewal of the thirty-year-old mains of the Denver Steam Heating Company—which company is included in the deal—at a cost of $400,000. In addition, it is the intention to construct a new plant capable of furnishing steam heat, which, without further extensions, will meet all demands for the next twenty years, in spite of the city's growth. Plans are being drawn for this steam plant, which will cost in the neighborhod of $750,000 before it goes into commission. The consolidation is the consummation of plans made by Mr. Doherty more than a year ago. The companies to be taken into the new corporation, with their outstanding bonds, are: The Lacombe Electric, with about $900,000; the Denver Steam Heating Company, with about $400,000, and the Denver Gas & Electric Company. The latter has outstanding $6,000,000 of its own bonds and $2,500,000 three-year notes.

Hydroelectric Development in British Columbia.—The Prince Rupert Hydroelectric Company, Limited, has been incorporated and organized by interests controlling the Western Canada Power Company of British Columbia, including Charles H. Cahan, K. C., H. A. Lovett, K. C., of Montreal; R. F. Hayward, general manager of the Western Canada Power Company; Prof. L. A. Herdt, of Montreal, and R. Brutinel, of British Columbia. The capital stock to be issued is $3,000,000 with $2,500,000 of bonds. The latter are being issued at 92½, carrying a bonus of ordinary shares equal to 40 per cent. of the par value of the bonds issued. The company has acquired control of the Timpsean Light & Power Company, the Continental Power Company, and the water rights on the Khtada and Falls Rivers, branches of the Skeena River. The water-powers are located about 42 miles from Prince Rupert and are said to be capable of developing at least 25,000 hp. The company proposes to develop 1500 hp at once by means of a provisional power plant to supply the immediate demands of Prince Rupert and to proceed to the construction of a permanent installation capable of supplying 15,000 hp, to be completed within three years or as soon as the Grand Trunk Pacific Railway shall be completed to the Pacific Coast. A gas-producing plant will also be installed at Prince Rupert with a capacity of 75,000,000 cubic feet of gas per annum.

Long Acre Electric Light & Power Company.—Following the decision of the Public Service Commission of the First District in New York to consider the amounts of securities which the Long Acre Electric Light & Power Company will be permitted to issue, as mentioned in the *Electrical World*, June 1, 1911, the company is preparing to extend its lines to distribute energy throughout Manhattan and the Bronx. This case has been before the Public Service Commission for some little time. The company has a perpetual franchise for supplying electricity in the two boroughs mentioned above. This franchise originally covered Forty-second Street, New York, and the immediate vicinity. Following an order of the city compelling the removal of wires from poles a few years ago, the American Illuminating Company, which operated in the lower section of Manhattan, retired from business and its franchise was acquired by the Long Acre Company. The Long Acre Company now has a small generating station at Forty-second Street and Second Avenue, with underground wires from Forty-second Street, supplying energy to several customers in the theatrical district, including the Criterion Theater. It is planned to extend these lines both north and south from Forty-second Street as soon as all details are perfected.

Fair Dealing Between Public-Service Corporations and the Public.—At the last session of the recent New York convention of the National Electric Light Association, H. M. Byllesby, of Chicago, read a paper, not down on the program, entitled "Breadth of View in Public Utility Appraisals." He made a plea for a better mutual understanding between public utility companies and the public they serve, stating that there should be a strict accountability in all corporate matters, but if this is conceded by the companies, they should receive adequate and proper protection. With a better mutual understanding there will be an increasing improvement in the service, and in general a continual lowering of rates, although, of course, the lowering of charges cannot go on indefinitely. Mr. Byllesby urged that great care be exercised in making appraisals of public utility plants for rate-making purposes, and pointed out that the estimates of engineers for new enterprises are usually below the actual cost of the work. He contended that if engineers err in their estimates prior to construction, they may make mistakes also in estimating the cost of completed work.

Independent Telephone Company Plans Extension.—Receivers for the Interstate Independent Telephone & Telegraph Company have received permission from Judge Kohlsaat, of the United States Circuit Court, to borrow $190,000 for improvement of the service and lines of the company. In April last the court approved an agreement between the telephone company and the Illinois Tunnel Company making it possible for the Interstate company to furnish service to Chicago subscribers. The present plan includes the extending of 4100 miles of new wire into Aurora, Bellowington, Joliet, Peoria, Decatur, Ill.; Clinton, Ia., and St. Johnston, Ind., and two lines to Springfield. The cost of extending this part of the system is close to $175,000. The loan is to be protected by a general mortgage through the Chicago Title & Trust Company.

Electrical Construction.—Among the items printed under Construction News in the present issue are announcements of proposed new plants or considerable extensions to present plants at Colorado Springs, Col.; Mishicot, Wis.; Greenville, Cal.; Downington, Pa.; Sebewaing, Mich.; McKenzie, Tenn.; Gadsden, Ala.; Motley, Minn.; Chamberlain, S. D.; Sacramento, Cal.; Des Moines, Ia.; New Orleans, La.; Washington, Ga.; Vancouver, B. C., Can.; Elwood, Ind.; Marion, N. Y.; Amityville, N. Y.; Madison, Wis.; Stettler, Alta., Can.; San Francisco, Cal.; Washington, D. C.; Hot Springs, Ark.; Prince Rupert, Sask., Can., and Tupelo, Miss.

Fort Wayne Electric Works Becomes General Electric Branch.—On June 1 the Fort Wayne Electric Works, which was capitalized at $2,000,000, gave up its charter as a State corporation and is to be known hereafter as the General Electric Company, Fort Wayne Branch. The control of the company has been vested in the General Electric Company for a considerable length of time. Changes are expected to follow in the local board of directors.

Electric Boat Company of New York.—The Chilian government has awarded a contract for two submarine boats to the Electric Boat Company, of New York. The total cost of these boats will be about $1,000,000. They are to be built at Seattle, and they will be sent to Chili under their own power.

Financial.

The Week in Wall Street.

STOCK transactions and prices have been irregular during the past week, with total sales reaching 2,946,879 shares, as compared with 2,530,758 for the last report. Prices declined sharply upon receipt of the decision in the American Tobacco case, but recovered during the middle of the week and were maintained until this Monday, when a decline was again registered. In the bond markets the same strength which has given a buoyant tone to the market in the past month continues to be shown, and in the week just past was effected one of the largest single transactions in railroad bonds ever made on the Stock Exchange. This was a sale of $1,000,000 Atchison convertible 4's of the issue of 1960, the price being 105. Another ture of the week was the announcement of the Great Northern Railway's $600,000,000 mortgage. The influence of the American Tobacco case is still felt in financial circles, and the price-cutting in the steel trade adds perplexity to the general situation. The many incidents accompanying each of these factors are the source of widespread comment. Events are occurring in a decidedly spasmodic manner and are giving an equally irregular tone to the stock markets. The rapid response of the market to varied reports is added proof of the uncertainty which still attends the situation. In spite of the growing understanding of the Standard Oil and American Tobacco decisions there are several questions of moment which must be solved before the outlook in the stock markets will become greatly improved. The Canadian reciprocity agreement is still in an unsettled condition, the trouble in Mexico does not seem to be clearing up as rapidly as might be desired, and the prospects of government regulation of corporate enterprise is a matter of concern. Interest in the speculative markets is increasing, but it is yet too soon to look for a revival of briskness. Money is becoming a trifle firmer. Rates, June 5, were: Call, 2¼@2½ per cent; ninety days, 3@3¼ per cent. The quotations in the table are those at the close of June 5.

NEW YORK.

	May 29.	June 5.	Shares Sold.		May 29.	June 5.	Shares Sold.
All. Ch.....	9¼	9	3,925	Int. Met., pf.	52⅞	53½	6,400
All. Ch., pf..	33	33	3,300	Mackay Cos..	90*	90⅛	100
Amal. Cop...	67¾	67¼	78,760	Mackay C.,pf.	76¼*	75¾*	100
Am. D. T....	20½*	20½*	———	Man. Elev...	136⅝	138	120
Am. Loco....	41¼*	41½	1,100	Met. St. Ry..	15*	15*	———
Am. Loco., pf.	108¼*	108¾*	100	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	82*	82*	100	Steel, com...	78⅜	77¾	560,210
Am. T. & T..	148¾	149¾	17,492	Steel, pfd...	118⅝	119	7,625
B. R. T.....	80	85⅝	24,910	W. U. T.....	82⅛	81½	13,950
Gen. Elec....	167½	165	24,227	West'h, com..	78½	77	32,300
Int. Met.....	18⅞*	19½	1,900	West'h, pfd..	118	118	290

PHILADELPHIA.

	May 29.	June 5.		May 29.	June 5.
Am. Rys.....	44½	44*	Phila. R. T.....	17¾	19⅛
El. Co. of A.....	12*	11⅞*	Phila. Elec.....	16⅜	16½
Elec. St. B'ty.....	54	54	Phila. Trac.....	82½*	83¼
Elec. St. B'ty., pfd..	30*	30*	Union Trac.....	46¼	48½

CHICAGO.

	May 29.	June 5.		May 29.	June 5.
Chi. City Ry.....	186*	186*	Chi. Tel. Co.....	123	14*
Chi. Rs., Ser. 1....	80*	80*	Met. El. Co.....	26*	25*
Chi. Rs., Ser. 2....	22½*	22½*	Met. El., pfd.....	72¾*	72½
Com. Edison.....	129⅛	129½*	Nat'l Car.....	120*	120*
Chi. Subways.....	4⅛*	4¼*	Nat'l Car, pfd.....	120*	119*

BOSTON.

	May 29.	June 5.		May 29.	June 5.
Am. T. & T.....	148⅞	149¾	Mex. Tel.....	4*	4*
Cum. Tel.....	157½	157½*	Mex. Tel., pfd.....	6½*	6*
Edison E., Ill.....	286¾	287*	N. E. Tel.....	146*	146¾
Gen. Elec.....	167¾	165½	W. T. & T.....	19⅝	19
Mass. E. Ry.....	21¼	23¼	W. T. & T., pfd....	96	97*
Mass. E. Ry., pf....	89½	90⅞			

*Last price quoted.
Shares sold for week May 29 to June 3.

Financial Notes.

Portland Railway, Light & Power Company.—The Portland Railway, Light & Power Company since 1906 has owned all of the stock, properties and franchises of the Oregon Water Power & Railway Company, the Portland Railway Company and the Portland General Electric Company, $7,486,000 of whose first mortgage 5 per cent bonds were recently listed on the New York Stock Exchange. The financial interests of these companies are closely allied, and the earning statements of the Portland Railway, Light & Power Company include those of its three subsidiaries. Up to Jan. 1, 1911, the Portland Railway, Light & Power Company had $5,000,000 cumulative preferred and $10,000,000 common stock. The preferred stock was retired on that date at 105 and the capital stock increased to $25,000,000, of which 65 per cent was paid. In effecting this financing, the holder of each share of common stock received the privilege of surrendering his share and paying $62.50 in cash and receiving in return two and one-half shares of the new stock, 65 per cent paid. If the earnings continue for the rest of the year on the scale shown during the first four months, the company will earn in 1911 more than 10 per cent on this $16,250,000 stock. The earnings on this basis were 9.3 per cent in 1910 and 7 per cent in 1909. The company's surplus at present totals $1,500,000, and, while its working capital is small, the company had on April 30 of this year about $500,000 cash on hand. The Portland Railway, Light & Power Company operates and owns 131 miles of single track in Portland, Ore., 12 miles of line in Salem and 61 miles of suburban road connecting Portland, Oregon City, Cazadero and Troutdale, making a total of single-track mileage of 226. In addition to its traction interests it owns and operates electric-light and power stations in Portland, Salem, Silverton, Woodburne, Oregon City and Vancouver, Wash., and also a gas plant in Salem.

Independent Telephone Companies to Merge.—Plans are being made for merging all the independent telephone companies of New York State with the New York (Bell) Telephone Company. In connection with this consolidation Theodore M. Brush, one of the directors of the Home Telephone Company, is quoted as follows: "Large financial interests believe that the proper handling of the telephone and telegraph business can be more economically and satisfactorily taken care of by the merging under one organization, and the public appears to acquiesce in that solution, provided all wire companies are put more or less under commission control. The independent companies affiliated with the Home Telephone Company are getting matters into such shape that they can be handled on these lines if it seems wise." The majority of the independent telephone companies west of Utica, N. Y., have already been acquired by the Bell interests, and it is expected that the Commercial Company of Troy will shortly be taken over.

Tri-City Railway & Light Company.—The earnings of the Tri-City Railway & Light Company for April show a substantial increase over those for the corresponding period of last year. The gains are most marked in the electric department of the company, in which a gain of more than 16½ per cent is registered for this period. The earnings of the railway department also increased in a substantial manner, and the gross earnings from all sources increased 45½ per cent. The gain in net earnings is approximately 18¾ per cent; the balance for dividends increased 35.37 per cent, and the surplus after deduction of preferred stock dividends shows an increase of very nearly 70 per cent. For the twelve months ended April 30 the company earned a surplus over preferred stock dividends of $366,976, as against $249,142 in 1909. This represents 4.07 per cent on the $9,000,000 outstanding capital stock, comparing favorably with 2.76 per cent in 1910.

Yonkers Lighting Company Shares Sold.—The New York Edison Company has obtained permission from the Public Service Commission of the First District, New York, to purchase ninety-five shares of the stock of the Yonkers Electric Light & Power Company, the price of which is not to exceed $7,125. There are 2000 shares of the Yonkers Lighting Company stock, of which the New York Edison Company has acquired 1905 shares from time to time. Commissioner Maltbie, who conducted the hearings in this matter, is quoted as saying that the purchase of this stock has no bearing on the possible merger of the companies, and that the acquisition of the stock will not change the relations existing between them.

Parkersburg & Ohio Electric Company.—C. L. Williams, of Parkersburg, W. Va., has been appointed receiver of the Parkersburg & Ohio Valley Electric Railway Company. This concern was formed with a view of building an electric road from Parkersburg, W. Va., to the Pennsylvania line. The receivership was made upon motion of J. M. Jackson, of Pennsylvania, who owns $52,000 of first-mortgage bonds on the road.

Annual Report of J. G. White & Company, Inc.—Under date of May 24, Mr. J. G. White, president of J. G. White & Company, Inc., submits the eighth annual report to the stockholders. This report is for the year ended Feb. 28, 1911, and shows an increase in the surplus for the year from $391,394 to $485,529. Nearly all the properties in which the company is interested have shown satisfactory increases in earnings during the year, and some of them have also increased their rates of dividends. Mr. White says that while in general there is not great activity in engineering and construction lines, he is able to report that the company has secured recently a considerable amount of new work, and has fair prospects of securing additional new work in the near future. The balance sheet shows a total of $4,629,963 in assets. The largest item is $2,317,959 in securities owned and syndicated participations. This shows an increase from the $1,765,816 of a year ago. The good will, purchase of business, plant, tools, instruments, etc., are valued at $1,499,037, while deferred charges and plant, tools and equipment, less depreciation, are valued at $148,902. The latter account shows a decrease from the $331,160 of a year ago. Accounts receivable amount to $344,447 and cash in banks and on hand is $266,389. The liabilities include $3,500,000 for capital issued, $530,855 for bills payable, the surplus before mentioned and two smaller items. Mr. White is president of the company and F. H. Reed, L. N. Farnum and J. H. Pardee are respectively first, second and fourth vice-presidents. R. B. Marchant is treasurer of the company and H. S. Collette is secretary. The authorized capital stock of the company is $5,000,000, divided into $2,000,000 of common stock and $3,000,000 of 6 per cent preferred stock.

Public Utility Offerings.—New York banking houses are offering $1,871,000 Kentucky Traction & Terminal Company 5 per cent first and refunding mortgage gold bonds, due February 1, 1951. The Kentucky Traction & Terminal Company owns and operates electric street and interurban railways in and between the cities of Lexington, Frankfort, Georgetown, Nicholasville and Winchester, Ky., and adjacent territory. The proceeds of $800,000 of this issue will be expended in the construction of a new power plant and other improvements, and the remaining $1,071,000 were issued to refund underlying bonds. The issue is a first lien on forty-eight miles of electric lines and is additionally secured by pledge of the stock of the company controlling the gas, electric-light and ice business of Lexington, Ky. The major portion of the issue has been disposed of, and the unsold balance is offered at 94 and interest to yield about 5.35 per cent.

Long Island Lighting Company.—The Public Service Commission for the Second District of New York has authorized the Long Island Lighting Company to issue a first mortgage on all its property and franchises, conditioned to secure the payment of its 5 per cent bonds payable twenty-five years from date, to the amount of $6,000,000. This company was recently organized for the purpose of taking over several companies on Long Island and is authorized to issue capital stock to the amount of $300,000 at not less than par. In addition, the company is authorized to issue bonds to the value of $295,000, to be offered at a price not less than $85, on security of its mortgage.

Kansas Traction in Hands of Receivers.—Judge Hook, of the United States Circuit Court of Appeals, has named Ford F. Harvey, of Kansas City, and R. J. Dunham, of Chicago, chairman of the Metropolitan board of directors, as receivers of the Metropolitan Street Railway Company of Kansas City. The company was placed in the hands of receivers upon application of John M. Egan, president of the Metropolitan company. J. Ogden Armour, of Chicago, is a large stockholder in the company and is said to have a controlling interest.

Public Utility Earnings Increase.—The gross earnings of the Boston Suburban Electric Companies for May were in the neighborhood of $10,000, which represents an increase of 14 per cent over those of May of the previous year. The gross earnings of the Philadelphia Rapid Transit Company for the month of May were $175,000 in excess of those in the same month last year. The gross earnings of the Massachusetts Electric Companies were $86,500, or 15 per cent larger during May, 1911, than in May, 1910.

New Orleans Railway & Light Company.—When the time for deposit, under the agreement, of the preferred and common stock of the New Orleans Railway & Light Company held in the United States expired on May 31, more than two-thirds of the amount required had been deposited. In view of the fact that the time for deposit of the stock abroad does not expire until June 15, an extension until June 7 for deposit without penalty, of the New Orleans Railway & Light Company's stock held in America, was approved.

Hudson River Electric Company.—George W. Dunn, receiver of the Hudson River Electric Company and its seven allied companies, which are mortgaged to secure a payment of $11,000,000, announces through George B. Curtis, United States Attorney, his representative, that these properties will be sold before passing into the hands of the receiver. Application is to be made June 14 before United States Judge Rae for foreclosure of this mortgage.

Massachusetts Companies Merge.—At special meetings of the Old Colony and Boston Northern Street Railway companies, held June 2, it was unanimously voted to merge the two companies. Provision was made to increase the capital of the Boston & Northern Street Railway Company by 7767 shares of preferred stock and 80,041 shares of common stock at par value to exchange for preferred and common stock respectively of the Old Colony Street Railway Company, the additional capitalization not to exceed $8,780,000.

Lynchburg Traction Bonds.—The Lynchburg Traction & Light Company, which is owned by the American Railways Company, has filed a mortgage at Lynchburg, Va., to the Real Estate Title Insurance & Trust Company, of Philadelphia. This is for securing a loan of $1,750,000 twenty-year 5 per cent bonds. It is understood that the loan is to retire outstanding 6 per cent bonds and for improvements and betterments to the street-railway system.

Chicago Company to Redeem Bonds.—The Chicago Suburban Light & Power Company, the successor of the Chicago Water & Light Company, will redeem the outstanding 5 per cent mortgage bonds of the latter company August 1, at its office, or at the office of the International Trust Company in Boston. These bonds are due in 1949 and are redeemable at 102½ and interest.

Hall Signal Company.—Notice has been given to the stockholders of the Hall Signal Company, the affairs of which have been before the public during the past month, that the time for depositing their stock in the Empire Trust Company has been extended to June 12. On June 1, the date first set for this purpose, about two-thirds of the stock had been deposited.

DIVIDENDS.

Butte Electric Light & Power Company, quarterly, 1¾ per cent, payable July 1.

Chicago Telephone Company, quarterly, 2 per cent, payable June 30.

Massachusetts Electric Companies, semi-annual, preferred, $2 per share, payable July 5.

Muskogee Gas & Electric Company, preferred, 1¾ per cent, payable June 15.

Oklahoma Gas & Electric Company, quarterly, 2 per cent, payable June 15.

San Diego Consolidated Gas & Electric Company, quarterly, 1¾ per cent, payable June 15.

Seattle Electric Company, quarterly, $1.75 per share, payable July 5.

Standard Gas & Electric Company, quarterly, 1¾ per cent, payable July 15.

REPORT OF EARNINGS.

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.

Period.	Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
April, 1911....	$604,632	$366,895	$237,736	$51,846	$185,890
April, 1910.....	565,054	321,239	243,815	48,731	195,084
4 m., April, '11.	2,383,309	1,403,810	979,498	206,682	772,816
4 m., April, '10.	2,230,652	1,274,096	956,556	191,594	764,961
ECONOMY LIGHT & POWER COMPANY.					
Yr., April, '11..	$430,375	$216,232	$214,143	$79,813	$134,330
Yr., April, '10..	406,746	217,654	189,092	75,743	113,349
FAIRMONT & CLARKSBURG TRACTION COMPANY.					
April, 1911....	$53,185	$18,889	$34,296	$16,942	$17,354
April, 1910.....	44,518	17,296	27,122	12,609	14,513
LAKE SHORE ELECTRIC COMPANY.					
April, 1911....	$91,958	$53,207	$38,751	$34,614	$4,137
April, 1910....	86,915	48,513	38,402	34,962	3,500
4 m., April, '11.	339,314	200,517	138,797	138,814	*17
4 m., April, '10.	322,770	193,470	129,300	138,923	*9,523

*Deficit.

General News

Construction News.

GADSDEN, ALA.—E. R. LeFevre and associates, who were recently granted a franchise by the City Council to supply electricity in Gadsden, are planning to build a hydroelectric power plant capable of developing 20,000 hp for transmission by electricity.

TUCSON, ARIZ.—The Great Western Power Company has commenced preliminary work on the installation of a large hydroelectric plant near Tucson. A large dam 360 ft. high will be built and form a storage reservoir to supply water for operating the plant.

BLYTHEVILLE, ARK.—It is reported that Hollipeter & Jontz, owners of the local electric-light plant, are contemplating the installation of a cold-storage plant.

CAMDEN, ARK.—Proposals will be received at the office of the Supervising Officer, Treasury Department, Washington, D. C., until July 3 for installing a conduit and wiring system, gas-piping system and lighting fixtures at the United States post office at Camden, Ark., specifications for which may be obtained at the above office or at the office of the custodian, Camden, Ark. James Knox Taylor is Supervising Architect.

HELENA, ARK.—The Helena Gas & Electric Company, it is reported, has decided to make extensive improvements to its plant involving an expenditure of about $200,000. The new machinery will include four 300-hp boilers, three 500-kw, 2300-volt turbines, three 200-kw rotaries, for which it is understood that bids are being received by the Scofield Engineering Company, Arcade Building, Philadelphia, Pa.

ENGLAND, ARK.—Bids will be received by the City Council for a thirty-year franchise for an electric-light plant. H. Galloway is recorder.

HOT SPRINGS, ARK.—Bids will be received until June 12 for construction of addition to power house at the Army and Navy General Hospital in Hot Springs, Ark. Further information will be furnished on application to Major G. D. Deshon, quartermaster.

BODIE, CAL.—The power plant of the Pacific Hydroelectric Power Company at Mono Lake has been rebuilt and put into commission, and is now supplying electricity in cities in Southern Nevada. The plant also supplies electrical energy to Bodie, Lucky Boy, Aurora, Rawhide, Fairview and other camps in Nevada. The plant was destroyed by snowslides last March.

FRESNO, CAL.—The Fresno, Hanford & Summit Lake Interurban Railway Company is contemplating the construction of an extension of its railway from Fresno to Calwa.

GRANGEVILLE, CAL.—The Grangeville Light & Power Company is reported to be making arrangements to extend its transmission lines into the Ten-Mile mining district.

GREENVILLE, CAL.—The Indian Valley Light & Power Company has acquired the Dunn water rights on the Feather River, near Seneca, where it is estimated that about 25,000 hp can be developed. Preparations are being made by the company to enlarge its plant, for which surveys are now being made for a ditch and transmission line. The capital stock of the company has been increased to $500,000. S. P. Dunn, who controlled the water right for seven years, is interested in the Indian Valley Light & Power Company.

LOS ANGELES, CAL.—Plans have been prepared by the Pacific Electric Railway Company for building an extension from Homewood and Redondo, a distance of about 6 miles. Another extension from Santa Ana to Anaheim will also be built.

LOS ANGELES, CAL.—The contract for installing all electrical apparatus, except turbo-generators, in the new power house of the Southern California Edison Company, at Long Beach, Cal., was awarded to J. C. Farrar & Company, San Fernando Building, Los Angeles, Cal., for $18,000.

LOS ANGELES, CAL.—Sealed bids will be received at the office of the United States Reclamation Service, Federal Building, Los Angeles, Cal., until June 23 for furnishing transformers for the United States Reclamation Service. For further information address the above office or the United States Reclamation Service, Department of the Interior, Washington, D. C. F. H. Newell is director.

LOS ANGELES, CAL.—The Secretary of the Interior has awarded contracts for the steam-power plant in connection with the Elephant Butte dam of the Rio Grande irrigation project, New Mexico, as follows: To the General Electric Company, of Schenectady, N. Y., for generators, exciters and switchboard, etc., for $31,371, and to W. E. Anderson, El Paso, Tex., for condensers, boilers, etc., at $44,258.

LOS ANGELES, CAL.—The Board of County Supervisors has ordered the franchise for electric-pole line applied for by the Pacific Light & Power Company advertised for sale. The franchise applied for extends east to the county limits, south to a line extending directly east of Redondo, also embracing territory south of Redondo, and the west line runs due north from Redondo. On the north the limit is approximately the line of the national forest.

MANTON, CAL.—Chadwick & Sykes, who had the contract for building the Coleman ditch for the Northern California Power Company, have given it up and turned the work back to the company. A. H. Clough, civil engineer for the company, will take charge of the work. The Colma power house is completed and all the machinery installed. The ditch will not be completed before the first of the year.

MARTINEZ, CAL.—The Pacific Gas & Electric Company is contemplating extending its transmission line to Danville to supply electricity for lamps and motors in that district.

MARYSVILLE, CAL.—Plans are being considered for the construction of an electric railway in Marysville, 3 miles in length. It is said that the railway will eventually encircle Marysville. G. W. Hail, of Marysville, is interested in the project.

SACRAMENTO, CAL.—The Sacramento Electric, Gas & Railway Company has purchased a site consisting of five acres on the bank of the Sacramento River, on which it proposes to erect a new power house.

SAN FRANCISCO, CAL.—The United Properties Company of California is reported to have purchased the property and holdings of the Northern California Power Company. The price paid for property is said to be about $8,000,000.

SAN FRANCISCO, CAL.—Plans are being prepared by Willis Polk, architect, for the construction of a reinforced concrete power house for the San Francisco Gas & Electric Company to be erected on Bush Street, near Larkin Street, to cost about $15,000. The building will be used as a substation in connection with the distributing system.

SONORA, CAL.—Notice of appropriation of two reservoir and dam sites on Clavey and Coffin Hollow creeks has been filed by T. M. McGovern and others. It is understood that the locations have been made for the Tuolumne River Power & Irrigation Company. Each dam is to be 150 ft. in height.

WATSONVILLE, CAL.—The Watsonville Railway & Navigation Company, it is reported, will soon award contracts for the construction of an extension from Watsonville to Rowes Corners, thence to Corralitos, and along the Santa Cruz road, returning to Watsonville. Another line is to be built along the San Juan road, Driscoll's lane and Salsipuedes road to a connection with the main line at Rowes Corners, and a branch may also be constructed to Pajaro and the Werner district. Concrete docks will be built at Port Watsonville. F. E. Snowden, 311 California Street, San Francisco, Cal., is president.

COLORADO SPRINGS, COL.—Extensive improvements are contemplated by the Colorado Light, Heat & Power Company to its system, which will involve an expenditure of about $50,000.

WESTBROOK, CONN.—The Essex Light & Power Company, of Essex, Conn., is planning to erect electric-light wires for the purpose of supplying electricity for lamps in Westbrook.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company has placed a contract with the General Electric Company, through J. G. White & Company, of New York, N. Y., for one 4000-kw turbo-generator set, one 100-kw turbo-exciter and two 1000-kw, 250-volt motor-generating sets, which will be used on its three-wire lighting system.

WASHINGTON, D. C.—Bids will be received by the office of the disbursing clerk, Department of Agriculture, Washington, D. C., until June 9 for furnishing the Forest Service with approximately 385 miles of insulated copper telephone wire, according to specifications, which will be furnished on application to the disbursing clerk. James Wilson is Secretary of Agriculture.

WASHINGTON, D. C.—One of the commercial agents of the Department of Commerce and Labor reports that an old-established house of Turkey, with branches in the commercial centers of the empire, would like to receive communications from builders of elevators for office buildings, hotels, apartment houses, of steel construction and latest construction; also dynamos and other machinery required for installation and operation of same. For further information address the Bureau of Manufacturers, No. 6793, Department of Commerce, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until June 17 under proposal 533 as follows: For furnishing 39,600 ft. of cable, type 213; 31,690 ft. of cable, type 214; 5000 ft. of cable, type 215; 5000 ft. of cable, type 216; 13,000 ft. of cable, type 217; 4000 ft. of cable, type 128; 24,500 ft. of cable, type 401; 14,000 ft. of cable, type 403; 18,000 ft. of cable, type 405; 1000 ft. of cable, type 406; 3000 ft. of cable, type 407, and ½ mile of cable, type 55; 2000 ft. of cable, type 321; 5000 ft. of cable, type 322; 20,000 ft. of cable, type 325; 2000 ft. of cable, type 327; 4000 ft. of cable, type 305; 75,000 ft. of cable, type 53; 35,000 ft. of cable, type 55; 20,000 ft. of cable, inside twisted pair wire, No. 18; 500 ft. of brass wire, No. 12; 10 spools buzzer wire, 3000 ft. stranded wire, 75 miles insulated wire, No. 9; 400 miles of pothead wire; 5100 ft. of submarine cable and two terminal bells. Captain A. S. Cowan is disbursing officer.

JACKSONVILLE, FLA.—The Board of Bond Trustees has awarded a contract to the James N. Bruin Company for building certain portions of the new electric-light station, to be erected on Talleyrand Avenue. The Scofield Engineering Company, of Philadelphia, Pa., has charge of the engineering work.

JACKSONVILLE, FLA.—A permit has been secured by the Jacksonville Traction Company for the erection of a new power plant 133 ft. long, 98 ft. wide and three stories high, of concrete, brick and corrugated galvanized iron. The equipment will include two 57-in. barometric condensers, three 600-hp water-tube boilers and two 1200-kw generators, feed and vacuum pumps, etc. The station will have an output of about 2400 kw and will cost about $500,000.

DALTON, GA.—The East Tennessee Power Company, it is said, will apply to the City Council for permission to bring its transmission lines into Dalton to supply electricity in this town. The company is erecting a transmission line from its plant on the Ocoee River to Rome.

PERRY, GA.—The City Council, it is said, has decided to call an election on July 1 to vote on the proposition to issue bonds to the amount of $6,000 for the installation of a municipal electric-light plant in Perry.

ROME, GA.—The City Council has granted franchises to the East Tennessee Power Company and the Georgia Power Company to supply electricity in Rome. The franchises are for a period of twenty years and each company was charged $250 for the franchise. The plant of the Georgia Power Company is located at Tallulah, and the plant of the East Tennessee Power Company near Chattanooga, Tenn.

STILLMORE, GA.—F. P. Bryant and W. A. Brinson, Jr., are reported to be interested in the construction of an electric-light plant in Stillmore. It is understood that machinery has already been purchased.

WASHINGTON, GA.—Plans are being considered for extensions and improvments to the municipal electric-lighting system and power plant. The work includes extensions and improvements to power plant to cost $10,700; repairs to distributing system, $8,000; installation of electric pump at pumping station and erection of transmission line to pumping station, to cost $6,300. It is proposed to issue bonds to the amount of $30,000 to pay for the work.

HONOLULU, HAWAII.—The contract for the construction of pump house, plumbing and electric wiring at Ft. Ruger, Hawaii, has been awarded to the Lord-Young Engineering Company, of Honolulu, for $1,982, also the contract for furnishing and installing two triplex pumps, direct-connected to 40-hp motors, for $4,830. The Honolulu Construction & Draying Company, of Honolulu, was awarded the contract for construction of pipe line, pipe in tunnel, etc., for $20,707.

BOISE, IDAHO.—The Secretary of the Interior has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for furnishing hydraulic turbines for use in connection with the Boise irrigation project, Idaho, at a cost of about $17,310. The equipment will be installed at the Arrow Rock dam.

BOISE, IDAHO.—Contracts have been awarded by the Secretary of the Interior for apparatus for the Arrow Rock dam in connection with the Boise irrigation project as follows: To the Allis-Chalmers Company, of Milwaukee, Wis., three alternators, four auxiliary transformers and air compressors, at $19.450; for three air-blast transformers and two blowers to the Westinghouse Electric & Manufacturing Company, for $5,880, and to the General Electric Company, of Schenectady, N. Y., for switchboard, twenty-four disk switches, six electric circuit-breakers, supplies and two lightning arresters, at $6,096.

HOPE, IDAHO.—The Council is reported to have granted the Northern Idaho & Montana Power Company a franchise to supply electricity for lamps and motors in Hope. Work will soon begin on the erection of a transmission line, 14 miles in length.

CHICAGO, ILL.—Judge Kohlsaat in the United States Circuit Court has authorized the receivers of the Interstate Independent Telephone Company to borrow $190,000 for improvements to its lines and service. The company proposes to erect 4100 miles of new wire to Aurora, Bellowinton, Joliet, Peoria, Decatur, Clinton, Ia., and St. Johnston, Ind., and two lines to Springfield, at a cost of about $175,000.

COLCHESTER, ILL.—The electric plant of the Colchester Electric Light & Power Company is reported to have been destroyed recently by fire.

LEAMAN, ILL.—The Fulton County Coal & Power Company, recently incorporated, proposes to carry on a mining business and operate an electric-light plant. The company is capitalized at $200,000. The incorporators are: C. J. Buman, J. Loughrey and T. H. Dimon.

LENA, ILL.—Extensive improvements and extensions are being made by the Lena Electric Light & Power Company, which will include the installation of new boilers, generators and engine. When improvements are completed the company will supply electricity to operate the factory of the Lena Casket & Supply Company.

MOUNDS, ILL.—A. J. Dougherty, of Mound City, Ill., has submitted a proposition to the City Council offering to install a water-works system and to supply electricity for lighting the city for a term of twenty-five years.

MOUND CITY, ILL.—Plans are being considered by A. J. Dougherty, of Mound City, Ill., for the installation of an electric-light power plant and water works system in Mound City. Mr. Dougherty will soon apply to the City Council for a twenty-five-year franchise to operate the systems.

WHITEHALL, ILL.—The Alton, Jacksonville & Peoria Railway Company has awarded a contract for the construction of an extension from Godfrey, Ill., northwest to Jerseyville and extending into Calhoun County to Grommett & Johnson.

ELWOOD, IND.—The Bacon-Olds Company, it is reported, is planning to make extensive improvements to the plant of the Citizens' Light, Heat & Power Company, involving an expenditure of $100,000 and including the installation of new machinery and equipment.

GARY, IND.—The Gary & Southern Interurban Railroad Company, which is now building an electric railway from Gary to Crown Point, it is said, will extend the line to Cedar Lake and Lowell next year and thence to Kankakee, Ill

KOKOMO, IND.—The Kokomo, Marion & Western Traction Company is asking for bids for the construction of its proposed railway from Kokomo to Terre Haute. George J. Marott, of Indianapolis, Ind., is president.

MARTINSVILLE, IND.—It is reported that the City Council is contemplating making improvements to the municipal electric-light plant, including the installation of new equipment. H. K. Johnson is city engineer.

BONAPARTE, IA.—The installation of an electric-light plant in Bonaparte is said to be under consideration. J. A. Johnson and associates are interested in the project.

CHARLES CITY, IA.—It is reported that the Western Electric Company is contemplating extensive improvements to its local system, which will involve an expenditure of $50,000 during the coming year.

CORNING, IA.—C. K. Munns, owner of the local electric-light plant, has submitted a proposition to the City Council offering to sell the plant to the city for $18,000. If the price is not satisfactory he proposes to select a committee of three, Mr. Munns to select one member and the Council the other and the two members to choose the third, to determine upon a fair valuation of the plant on which the basis of the sale shall be made. At present the city is paying $1,600 per year for street lighting. The franchise of the light company expires in June, 1913.

DALLAS CENTER, IA.—The citizens have voted to grant the Adel Mill Company a franchise to install and operate a lighting system in Dallas Center.

DES MOINES, IA.—Preparations are being made by the Des Moines City Railway Company to build an addition to its power house during the coming year. The company has awarded a contract to the General Electric Company, of Schenectady, N. Y., for the installation of 4000-hp generating equipment.

DEXTER, IA.—Arrangements are being made for the construction of a municipal light plant, for which bids have already been received.

FAIRFIELD, IA.—It is reported that Paul & Adams, of Centerville, Ia., have been awarded the contract for improvements to the municipal electric-light plant.

FT. DODGE, IA.—The Northern Iowa Power Company has awarded the contract for the construction of a hydroelectric power plant to Butler Brothers, of St. Paul, Minn., for $178,000. The project includes the construction of an 18-ft. dam, an auxiliary steam plant and electric generating machinery. It is expected that the dam will be completed by Feb. 1, 1912.

MONTICELLO, IA.—The City Council is considering the question of installing an electrically-driven pump in connection with watre-works system to cost approximately $1,500.

NEVADA, IA.—The Nevada Electric Company, it is reported, is planning to extend its transmission lines to Roland, McCallsburg and Zearing to supply electricity for lamps.

NEWTON, IA.—The Council is reported to have decided to build a new municipal electric-light plant to replace the one recently burned.

PLEASANTVILLE, IA.—Plans are being made by the Knoxville Electric Company for extensive improvements to the local telephone system, including the construction of a new exchange.

SPRING HILL, KAN.—The question of installing an electric-lighting system in Spring Hill is reported to be under consideration. It is expected that the proposition will soon be submitted to a vote of the people.

NEW ORLEANS, LA.—Plans are being considered by the Southwestern Traction & Power Company for the erection of a new power house. F. W. Crosby, Tenegre Building, New Orleans, La., is interested in the company.

LEWISTON, MAINE.—Plans are being considered by the Lewiston, Augusta & Waterville Railway Company for the construction of an extension from Bath to Popham Beach, 12 miles in length.

WATERVILLE, MAINE.—The Central Maine Company is making arrangements to extend its transmission lines to Solon and Bingham to supply electricity for lighting those villages.

CAMBRIDGE, MASS.—The City Council has appointed a committee of five, consisting of Aldermen O'Neil and Sullivan and Councilmen Delaney, Tweedle and Toomey, to look into the matter of establishing a municipal lighting plant in Cambridge.

SALISBURY, MASS.—The Wilkinson Company, of New Bedford, Mass., electrical contractor, has secured a contract for extensive improvements at Salisbury Beach. The contract includes the installation of an electric-light plant with sufficient output to supply more than 10,000 lamps, the wiring of all the cottages for electric lamps, etc.

STERLING, MASS.—The contract for furnishing and installing equipment for the municipal plant, which is to supply electricity for street lighting and for lighting municipal buildings, has been awarded to the Western Electric Company, for $3,963. The transformer station is to be erected by the town.

BATTLE CREEK, MICH.—The Battle Creek, Coldwater & Southern Railway Company is negotiating for the sale of $120,000 in bonds, the proceeds to be used for the construction of its proposed electric railway to connect Battle Creek and Coldwater, a distance of 28 miles. Fred Warren is interested in the project.

HILLSDALE, MICH.—The Board of Public Works has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for equipment for the municipal electric-light plant, including a new 300-kw turbo-generator set, for $9,000.

IRON MOUNTAIN, MICH.—The Peninsular Power Company has awarded the contract for the construction of its large concrete dam at Twin Falls, on the Menominee River, a few miles above Iron Mountain, Mich., to the Newton Engineering Compay, of Milwaukee, Wis. Magnus Swenson is interested in the company.

LUDINGTON, MICH.—The Stearns Lighting & Power Company, Ludington, has purchased the property of the Interurban Light & Power Company in this city. It is understood that the Stearns Lighting & Power Company proposes to supply the Oceana County towns with electrical service from a central plant. The village of Hart is making arrangements to secure electricity for operating the municipal electric system from the company and close down its generating plant. Ludington, Scottville, Pentwater and Shelby will also be served by the Stearns company.

MARQUETTE, MICH.—The contract for the construction of a dam on the Dead River is reported to have been awarded to Powell & Mitchell, to cost approximately $57,000. Wahlman & Trebilcock, of Ishpeming, Mich., are reported to have secured the contract for building the Silver Lake dam, to cost about $15,000.

NEWBERRY, MICH.—The proposition to issue bonds to the amount of $11,500, the proceeds to be used for the construction of a municipal electric-light plant, is under consideration.

SEBEWAING, MICH.—At a special election held recently the citizens voted to install a municipal electric-light plant. Work on construction of the plant will begin as soon as arrangements can be made for issuing bonds and awarding contract.

ANOKA, MINN.—The residents of Anoka have subscribed to $30,000 in capital stock of the Minneapolis & Northern Railway Company, which proposes to build an electric railway to connect Anoka, Onaway and Fridley with Minneapolis, Minn. W. J. Whitcom, of Minneapolis, Minn., is president of the railway company. It is expected to have the road completed to Anoka by Aug. 1.

BRAHAM, MINN.—The Village Council has granted the Eastern Minnesota Power Company a franchise to install an electric-light plant in Braham.

BRAINERD, MINN.—The Board of Water and Light Commissioners has awarded the contract for equipment for street-lighting system to the Northwestern Electric Equipment Company, of St. Paul, Minn., for $3,080.

DULUTH, MINN.—It is reported that the Minnesota Canal & Power Company is preparing plans for the development of a hydroelectric power plant.

EXCELSIOR, MINN—The Belleplaine Electric Light & Power Company, of Belleplaine, Minn., has been granted a franchise to construct and operate an electric-light plant in Excelsior. It is proposed to erect a plant to cost about $12,000.

FERGUS FALLS, MINN.—The question of submitting the proposition to issue bonds for extensions and improvements to the municipal electric-light plant is under consideration.

MOTLEY, MINN.—C. Thompson, representing St. Paul and Brainerd capitalists, is contemplating the construction of a power dam on the Crow River to supply electricity for lamps and motors to the towns on the Cuyana range.

OLIVIA, MINN.—Plans are being considered by the Montevideo Electric Light & Power Company, of Montevideo, Minn., to extend its transmission lines from its plant at Minnesota Falls to Olivia, Renville and Danube to supply electricity in those places.

PRINCETON, MINN.—The Village Council has granted the Eastern Minnesota Power Company a franchise to install and operate an electric-light plant in Princeton.

ST. PAUL, MINN.—Mayor Keller has authorized Oscar Claussen, city engineer, to prepare specifications for street lighting, on which bids will be advertised for. An appropriation of $75,000 has been made for the purchase of street-lighting equipment. If satisfactory bids for street lighting are received it is thought that no effort will be made to provide municipal street-lighting equipment this year.

WINONA, MINN.—The City Council has granted the Minnesota-Wisconsin Power Company a franchise to supply electricity for lamps and motors in Winona.

TUPELO, MISS.—Sealed proposals will be received by the Mayor and Board of Aldermen of the city of Tupelo, Miss., until June 16 for furnishing machinery and equipment for municipal electric-light plant as follows: Two cross-compound condensing, 4-valve or Corliss-type engines, for direct connection; two 250-kva, three-phase, 60-cycle, 2400-volt, 200-r.p.m. revolving-field-engine-type generators, complete with field rheostat; one motor-driven exciter and one steam-driven exciter to excite above generators and running in parallel at 80 per cent factor; one generator voltage regulator; a street-lighting system providing for 125 tungsten lamps, and 15 metallic-flame arc lamps complete with rectifier; one 60-hp, 2200-volt, three-phase, 60-cycle, 690-r.p.m. squirrel-cage induction motor with chain drive; one 5-hp, 220-volt, three-phase, 60-cycle, 1720-r.p.m. induction motor, direct connected to centrifugal pump of sufficient capacity to deliver 350 gal. of water per minute against 15-lb. pressure; seven 2½-kw transformers, thirteen 5-kw transformers, seven 7½-kw transformers, eight 10-kw transformers, marble switchboard, consisting of eight panels. Bids will also be received for materials for overhead pole-line construction. Plans and specifications are on file at the office of C. E. Goodlet, city clerk, and at the office of R. C. Huston, 1634 Exchange Building, Memphis, Tenn., consulting engineer.

BELTON, MO.—At an election held recently the citizens voted to issue bonds for the installation of an electric-light system in Belton, Mo.

COLUMBIA, MO.—The contract for construction of power plant complete has been awarded to the John W. Danforth Company, of Buffalo, N. Y., for $84,882. Henry H. Humphrey, 1505 Chemical Building, St. Louis, Mo., is consulting engineer.

INDEPENDENCE, MO.—The installation of an additional boiler in the municipal electric-light plant, to cost $2,900, has been recommended to the City Council by the light committee and A. L. Nichols, superintendent of the plant.

ST. LOUIS, MO.—Plans are being considered by the Springfield & Central Illinois Traction Company for the construction of an interurban railway from Springfield to Southern Illinois with a branch from Greenville to Edwardsville to connect with other lines for St. Louis. The proposed railway will be 320 miles in length. The cost of the road is estimated at $16,000 per mile. The company is capitalized at $5,000,000.

SPRINGFIELD, MO.—Preliminary surveys have been made by the Springfield & Western Railroad Company for its proposed electric railway to connect Springfield and Joplin and intervening towns, 90 miles in length. H. D. Mackay, of Springfield, Mo., is president, and J. P. McCammon secretary and superintendent.

SPRINGFIELD, MO.—It is reported that improvements are contemplated to the system of the Springfield Gas & Electric Company and the Springfield Traction Company, which will involve an expenditure of about $300,000. W. A. Bixby is general manager.

KALISPELL, MONT.—The construction of an electric railway from Kalispell to Polson is reported to be under consideration. David R. McGinnis is said to be interested in the project.

SHERIDAN, MONT.—The Madison Power Company, it is reported, is planning to supply electricity in Sheridan, Alder and Laurin.

HOAG, NEB.—Dr. C. B. Fall and others are said to be contemplating the construction of a dam on the Blue River. It is proposed to develop 500 hp to supply electricity in Beatrice and other towns.

LIBERTY, NEB.—The proposition to issue bonds for the installation of a municipal light plant, it is reported, will soon be submitted to a vote of the people.

OMAHA, NEB.—Orders have been placed by the Omaha & Council Bluffs Street Railway Company with the General Electric Company, of Schenectady, N. Y., for three 1000-kw, 600-volt rotary converters; four 1050-kw, three-phase transformers; three 350-kw, single-phase transformers; one 75-kw turbo-driven exciter, one blower set, one air-compressor and one switchboard. Two of the 1000-kw converters will be installed in the new South Omaha substation and the third will be placed in the power house in Omaha.

VERDI, NEV.—The Truckee River General Electric Company is making rapid progress on its new generating plant in Verdi. Water is to be taken from the Truckee River at Verdi and carried to a point 2 miles below the town through a ditch 36 ft. wide and 8 ft. deep. The water will be dropped 85 ft. through a penstock 2100 ft. long to the turbines. The plant will develop about 3200 hp, which will be transmitted to Mason, Nev., and the surrounding country for lamps and motors. It is expected to have the plant completed by Sept. 1.

CONCORD, N. H.—Arrangements have been made between the Concord Electric Company and the Manchester Traction, Light & Power Company, whereby the former will supply electricity at the power station of the Manchester Traction, Light & Power Company at Garvin's Falls as soon as the power plant of the Boston & Maine Railroad Company, at Eastman's Falls, in Franklin, is completed. Work on the erection of a transmission line between Sewall's Falls in Concord and Garvin's Falls in Bow will begin at once. The Concord Electric Company now supplies power to the Boston & Maine Railroad Company to operate the Concord & Manchester electric branch. When the new arrangement goes into effect it is understood that the Manchester Traction, Light & Power Company will discontinue the use of its steam-generating plant.

KEYPORT, N. J.—The Jersey Central Traction Company, of Keyport, N. J., which operates an electric railway between Keyport and Red Bank, it is reported, is contemplating extending the railway to Long Branch, via Little Silver, Port-au-Peck and Branchport.

SILVER CITY, N. M.—The Gilla River Development Company, which is contemplating a hydroelectric development, has engaged H. von Schon, of Detroit, Mich., as consulting engineer. The company proposes to develop a 500-ft. fall.

AMITYVILLE, N. Y.—The Public Service Commission, Second District, has granted the Long Island Lighting Company, recently organized, permission to issue a first-mortgage on its property and franchises to secure an issue of $6,000,000 in bonds. The company is also authorized to issue capital stock to the amount of $300,000 at not less than par, and to issue bonds to the amount of $295,000, to be sold to net not less than 85. The proceeds of the stocks and bonds are to be used for the purchase of the capital stock and outstanding bonds of the Northport Electric Light Company, of Northport, N. Y.; the Amityville Electric Light Company, of Amityville, N. Y.; the Sayville Electric Company, of Sayville, N. Y., and the Islip Electric Light Company, of Islip, N. Y.; also for improvements to the system throughout the entire territory covered, including the erection of a low-tension transmission line from Brentwood to Central Islip and Sayville to Ronkonkoma.

AUBURN, N. Y.—The Auburn Light, Heat & Power Company has awarded the New England Electric Construction Company the contract for supplying 135 ornamental lamp posts to be used in the inner-lighting district.

MARION, N. Y.—The Marion Power Company has received authority from the Public Service Commission to issue $9,500 in bonds, the proceeds to be used for the construction of an electric-light plant in Marion.

NEW YORK, N. Y.—The contract for the construction of the electric-light system at Gouverneur Hospital has been awarded to Anderson Martin, 1 Madison Avenue, New York, N. Y., for $6,320.

NEW YORK, N. Y.—The contract for installation of complete feeder system for lighting and power service of section No. 1, including spur line and service connection to Catholic church and service connection to new laundry building, in electric subway and conduit system at the New York City Home, Blackwell's Island, was awarded to Phillips Manufacturing Company, 60 Wall Street, New York, N. Y., for $1,638.

ROCKVILLE CENTER, N. Y.—The contract for installing a new boiler in the municipal electric plant has been awarded to the Springfield Machine & Boiler Company, Springfield, Ill., for $8,237.

SYRACUSE, N. Y.—The Public Service Commission, Second District, has authorized the Syracuse Lighting Company to exercise its rights and privileges under franchises granted by the town of Manlius to erect a transmission line in that town.

TROY, N. Y.—Negotiations are under way for the sale of the property of the Commercial Telephone & Telegraph Company and its subsidiary branches to interests believed to represent the American Telephone & Telegraph Company. The purchase of the plants of the Rensselaer Telephone Company and the United Message Corporation are also included in the negotiations. It is also proposed to absorb companies in Rensselaer, Albany, Saratoga, Washington and Warren Counties.

GRAND FORKS, N. D.—Arrangements are being made by the Grand Forks Street Railway Company to build an extension of its railway into East Grand Forks and to make other improvements to its system.

MINOT, N. D.—The Consumers' Power Company is reported to be contemplating rebuilding its power plant.

WAHPETON, N. D.—The installation of a new street-lighting system on Dakota Avenue is under consideration by the Commercial Club.

CINCINNATI, OHIO.—The City Council has passed an ordinance extending the district which may be lighted by the boulevard system.

COLUMBUS, OHIO.—Part of the recent appropriation of $75,000 for extension of the municipal electric-light plant and relief of water needs of North Columbus, will be used for the erection of a water and electric light boosting station in the vicinty of Eleventh or Twelfth Avenue. It is proposed to arrange to have the electric plant supply electricity to operate two emergency pumps having a rating of 250 hp each to provide for the increase in consumption of water during the summer months.

DAYTON, OHIO.—The Secretary of State has granted the Dayton Power & Light Company, recently incorporated, permission to increase its capital stock to $20,000,000. It is reported that it is proposed to consolidate the street-railway and lighting companies in Dayton.

EAST LIVERPOOL, OHIO.—The Tri-State Railway & Electric Company has placed an order with the General Electric Company, of Schenectady, N. Y., for a 300-kw, 2300-600-volt rotary converter.

STEUBENVILLE, OHIO.—The Steubenville & East Liverpool Railway & Light Company has purchased the electric-light plant owned by Erwin & Robinson, which supplies electricity for lighting a number of business houses on Fourth Street.

BARTLESVILLE, OKLA.—Judge Ralph Campbell, of the United States District Court, has ordered the property and holdings of the Bartlesville Light & Power Company to be sold at receiver's sale. E. L. Orr, of Tulsa, Okla., is receiver. The State Corporation Commission ordered the receiver to make repairs and improvements to the water system, costing $60,000, which the bondholders agreed to.

CHICKASHA, OKLA.—Judge Campbell, of the Federal Court at Muskogee, Okla., has appointed C. G. Johnson as receiver of the Chickasha Heat, Light & Power Company, of Chickasha. In the petition presented by the Central Trust Company of Illinois and the bondholders it is alleged the company has been badly mismanaged and has been unable to pay the interest on its bonds.

COMANCHE, OKLA.—It is reported that bonds have been voted for the installation of an electric-light plant in Comanche.

TALIHINA, OKLA.—The Talihina Light & Power Company has awarded the contract for construction of its electric-light plant to the Mullergren Engineering Company, of Poteau, Okla. The cost of the machinery is estimated at $10,000. O. P. Mullergren is president of the Telihina Light & Power Company.

BAKER CITY, ORE.—Plans are being formulated by the Commerical Club of Baker City, it is reported, for the construction of an interurban railway from this city into the Powder River Valley.

MEDFORD, ORE.—The Siskiyou Light & Power Company, of Yreka, Cal., it is reported, is contemplating extending its transmission line from the Fall Creek plant to Ashland and distributing electricity in the Rogue River Valley in connection with the Condor Power Company, for which surveys are now being made. The line will be of wooden construction, ten towers to the mile, and will carry current at 60,000 volts. The cost of the line is estimated at approximately $75,000. When completed it will tie into five different plants operated by subsidiary companies. The line will be connected with the plant of the Ashland Electric Light & Power Company in Ashland in the fall.

BUTLER, PA.—The Allegheny & Northwestern Street Railway Company has filed a mortgage for $700,000 in favor of the Guarantee Title & Trust Company, of Pittsburgh, Pa., to secure a bond issue of the same amount. The company proposes to construct and operate an electric railway cross country from Evans City to a point near Harmarville, where it will connect with the Allegheny Valley Traction Company's line, a distance of 21 miles. A contract for grading the line has been let.

DOWNINGTON, PA.—The Chester Valley Electric Light, Heat & Power Company has purchased about 2½ acres of land along the east branch of Brandywine Creek. The company is said to be planning to erect a power house to cost about $75,000.

HOMESTEAD, PA.—Arrangements are being made by the P. & A. Telephone Company to replace its present equipment in Homestead with a common-battery system, at a cost of $15,000.

MIDDLETOWN, PA.—The Middletown & Elizabethport Railway Company has filed a mortgage for $350,000 to secure funds to build an electric railway, 7 miles in length, that will complete the chain of railways that will unite Carlisle and Harrisburg with Lancaster and Philadelphia.

WASHINGTON, PA.—The Washington Electric Power Company of Pennsylvania, recently incorporated, will on July 1 take over the electric light and power plants in Washington, Canonsburg, McDonald, Oakdale and Waynesburg, Pa. It is understood that the company will supply electrical service to the towns mentioned from a large central power plant, and will erect transmission lines from Washington to Waynesburg and other points at once.

WASHINGTON, PA.—Notice has been given that application will be made to the Governor of Pennsylvania on June 22 for charters for electric-light and power companies in seventeen different boroughs and townships in Washington County, as follows: Washington, East Washington, Canonsburg, Houston, Burgettstown, Cecil, North Strabane, Chartiers, Canton, South Franklin, Mount Pleasant, Smith, Robinson, North Robinson, North Franklin, Amwell, South Strabane and Morris. The incorporators are: Charles H. Kennedy, E. S. Wheeler and H. P. Carr. It is proposed to supply electricity for lamps, heat and power in the places named.

PROVIDENCE, R. I.—The Rhode Island Company, which is controlled by the New York, New Haven & Hartford Railroad Company, has leased the Providence & Danielson Railway Company and the Seaview Street Railway Company properties for a term of 999 years. The first-named company operates 35 miles of street railways and the latter 20 miles.

PROVIDENCE, R. I.—The New York, New Haven & Hartford Railroad Company has secured the control of the Narragansett Pier Railroad Company, which extends from Narragansett Pier to West Kingston, a steam railroad 8½ miles in length. The railroad has been leased to the Rhode Island Company, of Providence, R. I., for a term of 999 years. The Narragansett Railroad will be equipped for electrical operation by the Rhode Island Company and operated in connection with the Seaview line.

WESTERLY, R. I.—The Westerly Light & Power Company, it is reported, is planning to extend its transmission line to Pleasant View to supply electricity for lamps in that place.

WOONSOCKET, R. I.—Preparations are being made by the Woonsocket Electric Machine & Power Company to build a large concrete dam at Bernon pond at a point between the present wooden dam and the Bernon Street bridge.

CHAMBERLAIN, S. D.—A company has been organized by local capitalists to install a new electric plant in Chamberlain. An election will soon be called to vote on the proposition to grant the company a franchise to operate an electric system. The street-lighting contract will expire July 1, 1911. The company is capitalized at $50,000. W. Hall Irens is president and J. H. Kennedy treasurer.

ESTELLINE, S. D.—The Estelline Telephone Company has been granted a franchise by the Council to construct and operate an electric light plant in Estelline. The Battery Power Company, of Milwaukee, Wis., has charge of the engineering work.

FT. PIERRE, S. D.—The installation of an electric-light plant with twenty-four-hour service in Ft. Pierre is reported to be under consideration.

CHATTANOOGA, TENN.—It is reported that C. E. James, of the Chattanooga Estates Company, has closed a deal whereby Chicago capitalists will construct a cement plant with a daily output of 9000 barrels of cement. The plant will be operated by electricity supplied by the plant of the Chattanooga-Tennessee River Power Company.

McKENZIE, TENN.—Bids will be received about July 1 for extensions to the municipal electric-light and water-works systems, for which bonds to the amount of $40,000 were recently voted. C. H. Jenks, of McKenzie, Tenn., is engineer in charge.

BISHOP, TEX.—Arrangements are being made to enlarge the local electric-light plant, owned by F. Z. Bishop. The installation of an ice plant is also under consideration. Bishop has not a post office.

CANYON CITY, TEX.—The Canyon City Power Company, recently organized, proposes to operate a lighting and power business in connection with an ice plant.

LULING, TEX.—The Luling Electric Light & Power Company is contemplating making extensions and improvements to its plant in Luling.

SHERMAN, TEX.—Preliminary arrangements are being made for the construction of an electric interurban railway between Sherman and Paris, Tex., a distance of 65 miles. John C. Wall, Mayor of Sherman and others are interested in the project.

WACO, TEX.—Announcement has been made of the sale of the properties of the Waco Gas & Electric Company and the Citizens' Street Railway Company to the Southern Traction Company, of Dallas. Steps have been taken by the Southern Traction Company for the construction of an electric interurban railway between Dallas and Waco. The plan includes the construction of street lines in East Waco and building a bridge across the Brazos River.

WAXAHACHIE, TEX.—The Commercial Club of Waxahachie, Tex., is reported to have signed a contract with the Stone & Webster Engineering Corporation, of Boston, Mass., for the construction of an electric interurban railway between Dallas and Waxahachie.

LYNCHBURG, VA.—The Lynchburg Traction & Light Company has filed a mortgage in favor of the Real Estate Title Insurance & Trust Company, of Philadelphia, Pa., to secure an issue of bonds to the amount of $1,750,000. It is said that the proceeds of the bonds will be used to retire outstanding bonds and for extensions and improvements to the local street-railway system.

RICHMOND, VA.—Bids will be received by the city of Richmond until June 14 for furnishing and erecting two centrifugal pumps, piping and water meters, two 200-hp electric motors, switchboard and wiring. E. E. Davis is superintendent of water department.

STAUNTON, VA.—Plans are being prepared for the construction of an electric railway from Staunton to Waynesboro. J. F. Cassell is engineer.

NORTH YAKIMA, WASH.—The Yakima Valley Transportation Company has commenced work on construction of an electric suburban line to Moxee City.

NORTH YAKIMA, WASH.—The City Council has awarded a contract to the Pacific Power & Light Company for the installation of an ornamental lighting system on Naches Avenue to cost about $6,000. Lamps will be erected on ornamental posts, four to each block.

TACOMA, WASH.—Plans are being considered by the Municipal Commission to extend the electric-light service to the Narrows, at a cost of $2,500 to $3,000.

TACOMA, WASH.—The Municipal Commission is reported to have awarded the contract for supplying incandescent lamps to the city for one year to the Home Electric Company, Tacoma, Wash., for $25,000.

TACOMA, WASH.—The contract for installing a power plant in the Rhodes Brothers' new department store is reported to have been awarded to the Caldwell Brothers Company, 1746 Pacific Avenue, Tacoma, Wash.

PANTHER, W. VA.—The Lathrop Coal Company, recently incorporated, is planning to develop coal mines covering about 500 acres, with a daily output of about 1000 tons. Electrical machinery will be installed. W. A. Lathrop is president, and William Leckie vice-president and manager.

PARKERSBURG, W. VA.—The West Virginia Western Telephone Company has been authorized to issue $15,000 in receivers' certificates, of which $10,000 will be used for improvements to its system and the remainder to pay off indebtedness.

CHIPPEWA FALLS, WIS.—It is reported that the Twin City Rapid Transit Company is securing flowage rights at Eagle Rapids, 8 miles from Chippewa Falls, with a view of developing same. It is estimated that 20,000 hp can be developed.

MADISON, WIS.—The Peninsula Power Company has received authority from the Railroad Commission of Wisconsin to issue 7500 shares of capital stock having a par value of $100, to be issued for money only and at not less than par. The proceeds will be used to purchase certain properties in Dickinson County, Mich., and Florence County, Wis., and for the rights and privileges incident to the construction and maintenance of a dam across the Menominee River, near Iron Mountain. The company proposes to install a 3000-kw hydroelectric plant, and to increase the total output to 4000 kw by means of steam auxiliary plants.

MILWAUKEE, WIS.—The Milwaukee-Western Electric Railway Company, it is reported, is planning to extend its electric railway to Beaver Dam, Wis.

MILWAUKEE, WIS.—Sealed proposals will be received at the office of the Board of Trustees of Public Museum until June 14 for furnishing material and installing plumbing and gas fittings, steam-heating apparatus, electric wiring, telephone and clock system, vacuum cleaning and light and power plant in the Public Museum Building on Eighth Street.

MISHICOT, WIS.—Negotiations are under way between Ira Beyer and Peter Rowlier and the Acker Electric Company, of Sheboygan, Wis., whereby the latter is to install an electric-light plant and water-works system in Mishicot. Power for operating the system is to be secured from a dam in the Mishicot River.

SPOONER, WIS.—The contract for improvements to the municipal electric-light plant has been awarded to the Power Engineering Company, of Minneapolis, Minn.

STETTLER, ALTA., CAN.—Plans are being considered by the town of Stettler for the construction of a municipal electric-light plant to cost about $17,000. The Galt Engineering Company, of Calgary, Alta., has charge of the engineering work.

PRINCE RUPERT, B. C., CAN.—The Prince Rupert Hydroelectric Company has acquired control of the Timpsean Light & Power Company and the Continental Power Company, Ltd., and the water rights on the Khtada and Fells Rivers, branches of the Skeena River. These waters, which are about 42 miles from Prince Rupert, it is said are capable of developing at least from 25,000 to 30,000 hp of electric energy. The company proposes to install a temporary plant to develop about 1500 hp to supply the immediate demands of the city of Prince Rupert, and to proceed with the work of construction of a permanent plant with an output of 15,000 hp. The company will also control the gas works in the city of Prince Rupert and install a gas-producing plant having a capacity of 75,000,000 cu. ft. per year. The directors are Charles H. Cahan, H. A. Lovett, R. F. Hayward, R. Brutinel and L. A. Herdt.

VANCOUVER, B. C., CAN.—Proposals will be received until June 26 by the Canadian Collieries (Dunsmuir), Ltd., for furnishing and installing two direct-connected hydroelectric units in the power house of the company, near Comox Harbor, Vancouver Island, B. C. Specifications may be obtained from W. L. Coulson, general manager, Victoria, B. C., or from H. K. Ownes, Central Building, Seattle, Wash., consulting engineer. Each unit is to develop 3750 kva at switchboard and include complete hydraulic and electric equipment.

MINNEDOSA, MAN., CAN.—Tenders will be received by the Minnedosa Power Company, Minnedosa, Man., until June 15 for the construction of power-station foundations and penstock, and the spillway and intake structures for the Minnedosa Power Company at Minnedosa. Plans and specifications may be seen at the office of H. F. Maulson, secretary, Minnedosa, and at the office of Andrews, Andrews & Company, Portage la Prairie, Man.

GUELPH, ONT., CAN.—The contract for the construction of the municipal radial railway extension in St. Patrick's ward has been awarded to P. H. Secord & Sons.

TORONTO, ONT, CAN.—The Eastern Power Company, Ltd., recently incorporated with a capital stock of $500,000, it is reported, is planning to construct a power plant on the Trent River. Thomson, Tilley & Johnston are said to be interested in the company.

TORONTO, ONT., CAN.—C. H. Rust, city engineer, has submitted estimates to the Board of Control of Toronto on the cost of building the proposed street railway on St. Clair Avenue and on Gerrard Street East. The construction of St. Clair Avenue line from Avenue Road to the Grand Trunk Railroad tracks, 2.65 miles, including rail construction, overhead construction, car bars and repair shops, passenger and operating equipment, transformer station and feeder wires and general engineering and other expenses, is estimated at $280,928. The cost of the construction of the Gerrard Street East line, from Greenwood Avenue to Main Street, 1.85 miles, is estimated at $225,780.

WINDSOR, ONT., CAN.—The Sandwich, Windsor & Amherstburg Railway Company has submitted a proposition to the City Council offering to supply electricity for operating the street-lighting system at the rate of $35 per hp per year.

New Industrial Companies.

THE AMERICAN ELECTRIC WATER-PURIFYING MACHINE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $500,000 to manufacture water-purifying apparatus, etc. The incorporators are W. A. Guthrie, E. A. Pfeffer and E. R. Sanford, all of New York, N. Y.

THE ELECTRIC CARRIER COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are F. R. Hansell, of Philadelphia, Pa.; G. H. Martin and S. C. Seymour, of Camden, N. Y.

THE HUGHES UNIVERSAL ARC LAMP COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $200,000. The incorporators are C. C. Hughes, of Philadelphia, Pa.; T. J. Rigby, of Pasadena, Cal., and W. H. Rigby, of Chester, Pa.

THE PATTERSON HYDRO-POSITIVE TRANSMISSION COMPANY, of Camden, N. J., has been chartered with a capital stock of $200,000 by T. S. Patterson, W. F. Eidell and J. A. MacPeak, of Camden, N. J. The company proposes to do a general electrical and mechanical engineering business, etc.

THE UNIVERSAL TROLLEY WHEEL COMPANY, of Springfield, Mass., has been incorporated with a capital stock of $300,000 to manufacture trolley wheels. L. J. Tetlow is president of the company and J. W. Steele treasurer, both of Springfield, Mass.

New Incorporations.

CHICAGO, ILL.—The Chicago Muncipal Subway Company has been incorporated with a capital stock of $25,000 by W. S. Jackson, C. M. Harlan and S. W. Cookins.

GRANVILLE, ILL.—Articles of incorporation have been filed for the Granville Water Company with a capital stock of $2,000 by J. F. Cole, George A. Harrop and George W. Hunt. The company proposes to construct and operate water works and electric-light systems.

EVANSVILLE, IND.—Articles of incorporation have been filed for the Evansville Independent Telephone Company with a capital stock of $25,000 by E. B. Oslage, H. G. Cooper and E. Q. Lockyear. The company recently applied for a franchise in Evansville.

GOULD, MONT.—The Landers Power Company has filed articles of incorporation with a capital stock of $100,000. The directors are Owen Byrnes, O. M. Lanstrum, F. B. Linderman, W. W. Patterson and F. M. Hall.

FRANCIS, OKLA.—The Francis Light & Power Company has been incorporated with a capital stock of $10,000. The directors are A. L. Mullergren, W. J. Donathan, of Potheau, Okla.; W. P. Chism, Albert Goetten and W. L. Shaffer, all of Francis, Okla.

SHAMOKIN, PA.—The Black Diamond Light, Heat & Power Company has been incorporated with a capital stock of $5,000. The directors are: William W. Ryan, of Shamokin, Pa., treasurer; N. J. Cox and W. A. Coulston, all of Shamokin, Pa.

WARWICK, PA.—The Warwick Township Electric Company has been incorporated with a capital stock of $5,000. The directors are: W. T. Robinson, of Philadelphia, Pa., treasurer; M. W. Stroud, W. T. Robinson, of Philadelphia, Pa., and W. C. Anderson, of Kingston, Pa.

WILLIAMSPORT, PA.—The Clinton Electric Company has been incorporated with a capital stock of $5,000. The incorporators are: Ernest H. Davis, of Williamsport, Pa., treasurer; Charles Cochran and Allen P. Perley, both of Williamsport, Pa.

WOODFORD, S. C.—The Woodford Ginning & Light Company has been granted a charter, with a capital stock of $40,000. The incorporators are: H. B. Knotts, G. W. Whetstone, J. S. Ulmer and W. E. Ulmer.

MANCHESTER, TENN.—The Duck River Power Company has been organized with a capital stock of $50,000 to construct and operate a hydroelectric-power plant.

MEMPHIS, TENN.—Articles of incorporation have been filed for the Lytle Electric Company by P. W. Lytle, H. P. Woods, W. C. Tupper, W. M. Waters, Sr., and H. H. Barker. The company is capitalized at $5,000.

PETERSBURG, TENN.—The Petersburg Electric Light & Power Company has been granted a charter with a capital stock of $2,100. The incorporators are A. C. Davis, George McAdams, J. A. Montgomery, J. C. McRady and O. F. Gill. The company proposes to supply electricity for lamps and motors in Petersburg, Tenn.

ALLEN, TEX.—The Allen Light & Power Company has been incorporated with a capital stock of $2,000 by J. N. Bush, S. P. Bush, G. I. Wilcox and J. B. Preston.

CHELAN, WASH.—Articles of incorporation have been filed for the Rubin Electric Power & Lumber Company with a capital stock of $500,000. William H. Schokel, of St. Paul, Minn., is interested in the company. Charles Rubin, of Chelan, Wash., is manager.

Personal.

MR. P. T. HANSCOM, formerly engineer of the Central Colorado Power Company, Denver, has been appointed general superintendent of the Great Western Power Company, San Francisco.

MR. W. F. HINE, a graduate of the Wisconsin University school of electrical engineering in 1907, has been appointed chief gas expert on the technical staff of the Public Service Commission of the First New York district, which comprises the city of New York.

MR. J. D. MOONEY has resigned his position with the Westinghouse bureau of publicity, where he was in charge of technical press matter, to join the editorial staff of the Hill Publishing Company, New York. On May 26 Mr. Mooney's associates at East Pittsburgh tendered him a farewell dinner at the Hotel Henry, Pittsburgh, a feature of which was a humorously conceived souvenir menu card.

DR. ROY W. MOORE, of the research department of the General Electric Company, Schenectady, will spend two months of the present summer in Berlin, Germany, investigating the processes of preparing tungsten for incandescent lamps. Dr. Moore graduated from the Worcester Polytechnic Institute in 1901 and from the University of Bonn, Germany, two years later. He has been engaged in research work at Schenectady for the past six years.

PROF. V. KARAPETOFF, who has been with the department of electrical engineering at Cornell University for seven years, will spend his sabbatical year vacation in the engineering department of J. G. White & Company, with headquarters in New York. During the present week Prof. Karapetoff will deliver an address before the Sigma Xi Society at the Worcester Polytechnic Institute, his subject being "Engineering Calculations Relating to Electromagnetic and Electrostatic Circuits."

MR. SAMUEL KAHN, formerly secretary and manager of the Union Light, Heat & Power Company, of Fargo, N. D., has been appointed manager of the Appalachian Power Company, with offices at Bluefield, W. Va. The Appalachian company, which was taken over by the Bylesby company June 1, supplies energy for the operation of a number of coal mines in the Bluefield and Pocahontas section. A 6000-kw steam-turbine plant is now in operation, and two water-power developments on the New River are to be added.

Trade Publication.

DIRECT-CURRENT INTERPOLE GENERATORS.—Circular 1194, recently issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has for its subject engine-driven direct-current interpole generators, type Q. The circular is well illustrated and contains information on the advantages of interpole construction and an entirely new line of standard direct-current generators just placed on the market.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 30, 1911.

13,247. ADJUSTABLE CASING FOR LAMP SOCKET; E. H. Freeman, Trenton, N. J. App. filed Aug. 9, 1910. Constructive details of a lamp socket of the bayonet slotted type.

13,248. SELF-ANSWERING SIGNAL SYSTEM; E. R. Gill, Yonkers, N. Y. App. filed Dec. 13, 1910. A local signal and a line are so arranged that upon closing the circuit through the local signal answering-back impulses are inductively impressed upon the line, such impulses audibly affecting the receiver in the sending station.

993,352. ELECTRIC DRILL; W. O. Duntley, Chicago, Ill. App. filed Jan. 20, 1905. An inclosed portable electric drill, comprising a tool shaft, a plurality of electric motors arranged annularly to the axial line of the shaft and operatively connected therewith.

993,359. ALTERNATING-CURRENT MOTOR; V. A. Flynn, Blackheath, England. App. filed March 2, 1908. The motor is provided with a neutralizing winding, a field winding displaced therefrom and connected in series relation therewith. A revolving member is connected in series with the neutralizing winding along one axis, and in series relation with the field winding along another axis. Means are provded for producing an alternating flux along an axis approximately coinciding with that of the neutralizing winding.

993,378. SWITCH; J. W. Jenson, Depew, and W. F. Bouche, Buffalo, N. Y. App. filed June 10, 1910. The two members of the switch mechanism are rotatable in opposite directions, and the device is pivoted eccentrically on the main switch member, and weighted so as to assume different positions thereon, depending upon the direction of rotation of its member.

993,391. METHOD FOR REDUCING METALS; R. J. McNitt, Niagara Falls, N. Y. App. filed Oct. 8, 1909. The metal is dissolved, alloyed or chemically combined with another metal volatile only at different temperatures and pressures than that at which the metal sought to be produced gives off its vapor. The solution, alloy or compound being maintained at a suitable temperature and an inert gas being passed through it.

993,414. ELECTRIC FURNACE; F. Sartori, Monteponi, Italy. App. filed Aug. 19, 1910. An electric furnace for the distillation of zinc and its ores or by-products.

993,417. ELECTRICAL CONTROL APPARATUS; W. M. Scott, Philadelphia, Pa. App. filed Jan. 6, 1910. An electric motor is arranged for operating a plurality of switches or circuit-breakers, mechanical means being provided for connecting and disconnecting the motor and each switch.

993,434. MULTIPLE SWITCH STARTER; F. R. Bacon, Milwaukee, Wis. App. filed Aug. 2, 1909. Automatic means are provided for checking the closure of a plurality of separately actuated manual switches normally free to be closed but tending to stand in open position.

993,442. TELEGRAPHY; J. A. Esslinger, Washington, D. C. App. filed May 23, 1910. An interacting relay shunts the induced and main line currents through its break points, to operate a reciprocating electromagnetic inductive sounder, which in turn operates a diaphragm receiver.

993,447. OSTEOPATH'S ELECTRIC OPERATING TABLE; C. W. Hotchkiss, Sandwich, Ill. App. filed Dec. 3, 1909. Constructive details.

993,459. ELECTRIC MOTOR; H. A. Rhodes, Denver, Col. App. filed July 20, 1909. Both members of a motor are arranged to rotate, a third member being provided to utilize the differential speed of the two members.

993,460. ELECTRICAL ALARM DEVICE; A. J. Rice, Lawrenceburg, Ky. App. filed April 27, 1910. Details of a self-contained alarm device mounted upon an insulating base.

993,475. ELECTRIC CURRENT CONTROLLER; G. G. Thompson, Muskegon, Mich. App. filed Jan. 5, 1911. The controller is provided with both starting and running fuses, so arranged that the starting fuse is automatically opened when the control lever is in its closed position, and automatically closed when the control lever is in its open position.

993,526. ELECTRIC SWITCH; A. J. Horton, White Plains, N. Y. App. filed Sept. 14, 1908. A movable contact of the switch is adapted to be held magnetically in engagement when the switch is moved in one direction. Means are provided for causing the contact to break engagement with the switch upon reaching a certain position.

993,561. APPARATUS FOR TRANSFORMING ELECTRICAL ENERGY INTO MECHANICAL ENERGY; H. B. Smith, Worcester, Mass. App. filed May 14, 1908. A revolving electrostatic field motor, the rotating field being produced by impressing displaced alternating emfs upon a number of circularly arranged plates.

993,610. SYNCHRONIZING DEVICE; F. E. A. Mathelot and H. G. Gentilhomme, Paris, France. App. filed April 23, 1908. Mounted opposite each other on separate shafts are two wheels, one having on its opposite face contacting sectors separated from the wheel and from each other by insulating material. The other wheel carries a flexible brush contacting when the wheels are in unison with the insulation between the sectors. The wheels are actuated by electromagnets, cams being mounted on the driving shafts of the device to be synchronized to make at predetermined intervals electric contacts with the terminals of the electromagnets.

993,611. ELECTROMAGNETIC POWER VELOCITY RATIO DEVICE, PARTICULARLY APPLICABLE FOR DRIVING AUTOMOBILES; A. H. Midgley, Forest Gate, and C. A. Vandervell, Acton Vale, England. App. filed May 7, 1909. A combination generator and motor having a common field magnet system is mounted so that the motor armature remains fixed, while the generator armature and the field magnets are adapted to move relatively to one another and to the motor armature, means being provided for exciting the field magnets and for conveying the energy generated by one armature to the other armature.

993,637. CIRCUIT-BREAKER; C. C. Badeau, Bethlehem, Pa. App. filed Feb. 19, 1908. One contact of a circuit-breaker is in the form of a carbon cylinder and the other in the form of a metal block. The block is provided with a curved notch on the side which engages with the carbon cylinder, the notch being circular in shape and having the same diameter as the cylinder.

993,638. PROPULSION OF VESSELS IN WATER; J. N. Bailey, Stratford, England. App. filed May 17, 1909. The equipment consists of a steam turbine driving an electric generator supplying energy to a motor on the propeller shaft. A controller is provided for governing the supply of steam to the turbine, and for affecting a reversal of the connections leading from the generator to the motor, and to cut off automatically the supply of steam from the turbine.

993,688. BURGLAR AND FIRE-ALARM SYSTEM; J. M. Johnson, Belleville, Kan. App. filed Oct. 12, 1909. A portion of the electrical signal circuit consists of a fuse held in tension by means of a rotatable drum. When the fuse is opened by excess temperature the drum revolves and thereby actuates the signal circuit.

993,727. ELECTRIC TOY; E. Sollmann, Hoboken, N. J. App. filed March 4, 1910. Details of a miniature electric railway, consisting of two running rails and a third contact rail.

993,756. SWITCH; F. C. Chlan, Baltimore, Md. App. filed Aug. 6, 1910. Details of a wall-type push-button switch, the head of which is provided with an approximately W-shaped engaging face pivotally connected with the supporting structure.

993,776. MANUFACTURE OF SILVERED GLASS MIRRORS; E. Hoorick, Brussels, Belgium. App. filed May 30, 1911. An apparatus for electroplating mirrors in which use is made of a central conductor and a number of spaced means carried by the conductor for electrically connecting the conductor with the edges of the mirror to be electroplated, the means extending at right angles with the conductor.

993,792. TROLLEY HARP; J. L. Perkins and C. W. Putnam, Holyoke, Mass. App. filed Jan. 28, 1910. Details relating to the mounting of a harp upon a trolley pole.

993,804. AUTOMATIC SWITCH; A. B. Strohm, Columbus, Ohio. App. filed Dec. 15, 1910. The switch mechanism is operated mechanically by means of a diaphragm responding to a pressure produced by the machinery which the switch is intended to control.

993,814. MOTIVE-POWER-CONTROLLING DEVICE; T. E. Barnum, Milwaukee, Wis. App. filed July 1, 1907. Device comprises a pair of moving members actuated by solenoids.

993,843. HIGH-VOLTAGE MERCURY-ARC RECTIFIER; O. O. Kruh, Schenectady, N. Y. App. filed Sept. 20, 1907. The tube is surrounded by a shield placed at the anode, and connected therewith in such a way as to equalize the potential between the anode and the shield.

993,870. FIRE ALARM; H. G. Perkins and G. H. Elliott, Topeka, Kan. App. filed Dec. 17, 1910. Constructive details.

993,872. MERCURY METER; W. H. Pratt, Lynn, Mass. App. filed April 9, 1908. The meter is provided with a cup-shaped armature revolvable in mercury between the poles of the magnet, the magnetic member substantially filling the interior of the armature. Conductors lead current to diametrically opposite edges of the armature; a retaining member, rigidly attached to the magnetic member and the conductors, is revolvably adjustable about the armature axis.

993,888. METHOD OF SEPARATING SUBSTANCE IN SUSPENSION; B. Schwerin, Frankfort-on-the-Main, Germany. App. filed Feb. 8, 1911. Covers a method of electro-osmotically separating substances suspended in a solution, which consists in adding to the solution an electrolyte which is capable of neutralizing the iron normally liberated at the electrode through which the substance tends to migrate.

993,899. VAPOR RECTIFIER SYSTEM; C. P. Steinmetz, Schenectady, N. Y. App. filed June 21, 1907. Between the source of supply and the rectifier are connected two reactive devices mounted upon the same core, and so arranged that the core is continuously magnetized in the same direction for current to either anode.

993,913. SILICON-OXYGEN PRODUCT; F. J. Tone, Niagara Falls, N. Y. App. filed Jan. 18, 1907. The product is condensed from gases produced by electrically heating a mixture of carbon and silica, which when treated with hydrochloric acid yields a residue of amorphous silicon.

993,944. ELECTRIC MOTOR ATTACHMENT FOR SEWING MACHINES; H. S. Baldwin, Lynn, Mass. App. filed Oct. 14, 1909. A motor-supporting bracket is hinged on an axis transverse to the shaft of the sewing machine, and a countershaft is joined in the bracket with its axis normally parallel with that of the machine.

993,961. ELECTROLYTIC LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed Oct. 11, 1907. In series with an aluminum cell lightning arrester is placed a spark gap shunted by a device operated by a time-limit relay, responsive only to a continuous discharge of current through the arrester circuit.

993,968. SNAP SWITCH WITH INCLOSED FUSE; F. C. De Reamer, Schenectady, N. Y. App. filed April 22, 1905. A carrier is pivoted on one of the two terminal clips, and the inclosed fuse is provided with blades projecting axially from the ends thereof, one of the blades being removably secured in the carrier and the other blade being adapted to enter the other clip.

993,973. THREE-WIRE GENERATOR; H. F. T. Erben and J. L. Burnham, Schenectady, N. Y. App. filed June 21, 1907. The generator is provided with three leads, two of which are connected to the main armature winding. There is also a continuous auxiliary winding closed upon itself, and generating a different emf from the main winding, and having different points connected to the main winding and to the third lead to maintain a constant difference of potential between the third lead and the other two.

993,975. TELEPHONE SUPPORT; Charles E. Flynn, Vale, Ore. App. filed Feb. 25, 1911. A slidable grip is mounted on the handle of the telephone, and means are provided on the grip for connecting with the receiver fork of the telephone in order to raise and lower the latter.

993,977. PRESSURE-OPERATED CIRCUIT CONTROLLER; F. J. Frasier, Minneapolis, Minn. App. filed April 19, 1910. A pressure-operated diaphragm is arranged to close contacts when the pressure exceeds a predetermined value.

994,010. METHOD OF AND APPARATUS FOR PRODUCING EXHAUSTED VESSELS; I. Langmuir, Schenectady, N. Y. App. filed Oct. 22, 1910. The method consists in heating an incandescent lamp during exhaustion to a temperature between 460 deg. C. and 520 deg. C. and shielding the walls of the lamp during exhaustion from pressure great enough to distort them by surrounding the lamp with a medium at substantially the same pressure as the medium inside the lamp.

994,011. SNAP SWITCH; I. Larsen, Schenectady, N. Y. App. filed Oct. 2, 1907. Constructive details.

994,022. PROCESS OF DISTILLATION; R. J. McNitt, Niagara Falls, N. Y. App. filed Sept. 18, 1909. Electrical heat produced by transformer action is employed for distilling substances which cannot be distilled by the application of external heat on account of the destructive effect of such heat upon the walls of the distilling vessels.

994,026. THERMAL ELECTRIC FIRE ALARM; J. W. Mowbray, Gleichen, Alberta, Canada. App. filed July 18, 1910. To the face of the device is secured a contacting post and supported thereto is a turnable shaft. A helical coil of contacting material is secured at one end to the post and at the opposite end to the turnable shaft.

994,030. TROLLEY-POLE ATTACHMENT; W. A. Peffer, Louisville, Ky. App. filed Oct. 24, 1910. The pole is provided with an extra arm carrying a second trolley wheel, intended for removing any undesired matter from the trolley wire.

994,039. TROLLEY HEAD AND HARP; J. Siragusa and R. E. Wood, Chicago, Ill. App. filed March 4, 1910. The wheel shaft is equipped with arms extending above the wheel and spanning the wire.

994,040. PUSH-BUTTON SWITCH; M. H. Spielman, New York, N. Y. App. filed Sept. 8, 1910. The switch is provided with a barrel having an interior annular groove and with contact devices, including a movable member and a ring-like pivot for this member sprung into and seated in the groove.

994,046. PROTECTIVE MEANS FOR SAFES; W. Weikel, dec'd, by E. E. Weikel, Middletown, Ohio. App. filed Dec. 14, 1910. An electric circuit which is closed upon attempted forcible entry to the safe is arranged to fuse a device containing material which poisons the air surrounding the safe.

994,058. ARMATURE; J. Coates, Lynn, Mass. App. filed March 27, 1907. The armature is of the spherical type intended for use on commutator type watt-hour meters. A supporting shell for the coils crossing at the ends of the armature is formed of two approximately hemispherical parts having raised portions adapted to raise a coil above the coil immediately below it at the crossing point of the coils.

994,060. RAILWAY SIGNAL; J. P. Coleman, New York, N. Y. App. filed Dec. 27, 1910. Constructive details relating to a railway signal depending upon gravity for assuming its position of indication.

994,067. BATTERY WELL; F. L. Dyer, Montclair, N. J. App. filed Nov. 8, 1910. A battery well is provided with double walls of fibrous material indurated with an infusible, insoluble final phenolic condensation product, and having an air space between the walls.

994,079. TELEGRAPH TRANSMITTER; B. P. Hayes, Topeka, Kan. App. filed May 17, 1910. Constructive details relating to a mechanical telegraph transmitter arranged to operate an automatic keyboard machine by the use of which messages in the Morse code may be sent at substantial speed without nervous effort on the part of the operator.

994,080. MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 17, 1908. The controller is arranged to change series-wound motors from series to parallel connection by means of the minimum number of switches.